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ABSTRACT

This guide was developed to provide assistance to North Dakota schools in improving their elementary mathematics programs. Use of calculators and problem-solving instruction is firmly suggested, and computers should also be integrated in the mathematics program. Following statements of philosophy and goals, the scope and sequence of skills for grades K-8 is presented for numeration; whole number operations; decimals; estimation; fractions; measurement; geometry; graphing, statistics, and probability; equations, expressions, and positive and negative numbers; ratio and proportion; percent; and problem solving. Then objectives are stated, by topic, for each grade level. In the following section sample test questions for each grade level are provided for each topic. A selection of activities is then given for primary, intermediate, and junior high school levels. Appendices contain position statements on calculators; computer software, including evaluation; textbook evaluation; basic skills; recommendations for school mathematics in the 1980s; and an eight-page bibliography. (MNS)

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THE STATE OF NORTH DAKOTA

Department of Public Instruction

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MATHEMATICS CURRICULUM GUIDE

K-8

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January, 1986

NORTH DAKOTA
MATHEMATICS CURRICULUM GUIDE

ELEMENTARY (K-8)

Dr. Wayne G. Sanstead, SUPERINTENDENT
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Bismarck, North Dakota 58505

January, 1986

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TABLE OF CONTENTS

Foreword i

Acknowledgements iii

North Dakota Mathematics Philosophy and Goals v

Mathematics in Perspective vii

Introduction to the Elementary Curriculum xi

Scope and Sequence of Skills K-8 xiii

Objectives K-8 . . . . . I-1

Sample Test Questions K-8 . . . . . II-1

Mathematics Activities K-8 . . . . . III-1

Appendix A: Calculators in Mathematics Education A-1

Appendix B: Computers in Mathematics Education B-1

Appendix C: Mathematics Textbook Evaluation C-1

Appendix D: NCSM Position Paper on Basic Skills D-1

Appendix E: NCTM Agenda for Action Summary E-1

Appendix F: Bibliography F-1

FOREWORD

The North Dakota Elementary Mathematics Guide was developed to provide assistance and support to local schools that want to improve their elementary mathematics program. This Guide is not a mandate to local systems, but rather an additional resource to be used by local schools in formulating their unique mathematics curricula.

Mathematics cannot be effectively taught with lecture and worksheets alone. Today's educators must be aware of learning styles and developmental stages of students and use this knowledge to accommodate each student through the use of differentiated instruction, manipulatives, activities and technology. In addition, the regular classroom teacher and the special education staff must cooperate to provide adequate instruction to handicapped, gifted, and special needs students. The increased pace of changing technology has made it increasingly essential for students to develop fully their mathematical abilities. Not only must a person be able to perform basic computational skills, but must be able to apply these skills to new applications.

In a rapidly changing society, people find it necessary to make practical solutions to problems that were not realized previously. Emphasis can no longer be placed merely on computational skills, but must be placed on problem solving skills as well. With the continued decreasing cost of minicalculators it is no longer necessary to burden people with time consuming computations. Once basic computation competency has been achieved, the integration of the calculator into the mathematics program is essential to allow students to focus additional attention on application problems.

In addition, students must be exposed to computer technology. This should not be an isolated experience, but integrated into the mathematics program as the computer has been integrated into society. The use of the computer as both a remedial and enrichment tool is merely a beginning. Educators must stay abreast of new uses for this valuable instrument.

Wayne G. Sanstead

Dr. Wayne G. Sanstead
Superintendent of Public Instruction

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In 1983, under the direction of Dr. Glenn Prigge, a state mathematics committee, consisting of educators from the state's colleges, universities, elementary, and high schools, was formed. Through the efforts of these people, the K-12 Mathematics Curriculum Guide was created.

A special thanks to the members of the Mathematics Curriculum Committee who have contributed so much of their time and efforts in making this Guide the useful document that it is.

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NORTH DAKOTA MATHEMATICS

PHILOSOPHY AND GOALS

PHILOSOPHY*

There has been much discussion in regard to mathematics content and teaching approaches. The current approach is to incorporate traditional concepts with some modern materials. The traditional concepts are amplified and clarified. They are no longer presented as isolated, unrelated ideas or rules. This organized body of knowledge leads to logical thinking which gives a better understanding of the scientific world. The greatest challenge of teachers is to provide students with enough basic mathematics to meet their needs as well as to create within them the desire to pursue the study of mathematics beyond the minimum.

The mathematics curriculum must reflect the rapid changes in society e.g. technology including the computer. Changes in mathematics instruction in the next decade probably will be motivated primarily by two things: an emphasis upon student learning and changes in technology. Teachers cannot be completely certain about the type of world in which students will be living or about the types of skills that will be required of them, but we do know that they will have to be able to adapt to new situations. Therefore, teachers must attempt to give them experience at facing new situations and working out solutions to problems that are new to them. There should be an emphasis on the discovery approach to learning as a way of continually confronting students with new situations. Furthermore, a rationale in terms of physical experiences or previously learned concepts should be given for each new concept that is learned. At the elementary level, varied experiences to help fix a concept should be provided.

GOALS

-- Problem solving should be the focus of all school mathematics.

-- Essential mathematical skills should be mastered by all students so that they can function in a technological society.

-- Mathematics programs should take full advantage of the power of calculators and computers at all grade levels.

-- An appreciation of mathematics should be developed.

-- The time spent in the study of mathematics should be increased and used efficiently and effectively.

*A Guide for Curriculum Planning K-12, 4th ed. (DPI, 1983)

MATHEMATICS IN PERSPECTIVE

Now is an exciting time to be in or to be a part of an elementary or secondary institution. The new national recognition of the importance of formal education has provided opportunities for self-examination and to initiate new efforts. Reflecting this environment, the North Dakota Department of Public Instruction has effected a writing of this new Mathematics Curriculum Guide.

As documentation of the interreliance of elementary and secondary education efforts, the Guide presents a curriculum map for elementary as well as secondary school programs. Without a strong elementary school curriculum, delivery of secondary school instruction is delayed and prone to falter. At worst, such secondary education is avoided by the student ill-prepared by inadequate elementary education. With this Guide, there is recognition of the positive potential of the structuring of a map for both elementary and secondary efforts, a must in the present environment.

The North Dakota Department of Public Instruction's perspective of the role for mathematics in the present (the now) is corroborated with an encompassing statement made by the National Council of Teachers of Mathematics. The Council's statement recommends that "Problem solving be the focus of school mathematics, basic skills in mathematics be defined to encompass more than computational facility, mathematics programs take full advantage of the calculators and computers at all grade levels, effectiveness and efficiency be applied to the teaching of mathematics, the success of mathematics programs and student learning be evaluated by a wider range of measures than conventional testing, more mathematics study be required of all students, mathematics teachers demand of themselves and their colleagues a high level of professionalism, and public support for mathematics instruction be raised to a level commensurate with the importance of mathematical understanding to individuals and society."

Mathematics is not just a pencil-paper subject; it is an interactive subject requiring communication. Testing, in the usual present day sense, should be done by teachers skilled in observing, questioning, stimulating, and structuring group and individual tasks. Development of the total student as a human is the true desired outcome.

The new North Dakota Mathematics Curriculum Guide reflects modern thinking concerning mathematics education. No longer will results or cognitive measures only be valued. Importance will be placed on the process in the context of the total student development approach, where helping students realize their potential in mathematics and develop a positive self-concept are primary goals. The present is now, and today's classroom teachers, educational management, and members of boards of governance have the opportunity for proaction!

MATHEMATICS IN PERSPECTIVE: FUTURE

As we are able to perceive it on the basis of today's technology alone, the future will be drastically different. Methods which were successful in the past may not work in the future, education will not be a function of school alone, and the emphasis will be on lifelong learning of skills.

In the past, people focused on solving problems of the world as it existed. Now and in the future, society will focus on problems in the world as humans have shaped it. Dennis Avery in his article "Futuristic Education" in Educational Leadership, February, 1980, advises us that these problems of tomorrow will require new skills, including a tolerance for multiple interpretations, and the ability to explore and create alternatives. In the 1990s, there will be a need to redefine knowledge, schooling, and education. The emphasis will be on learning how to learn, rather than on learning facts.

Certainly the implication is that instructional alternatives and new skills will be required of the teachers in the future. In this Guide, we have restated and reemphasized curricular goals; and we will need provisions for ongoing inservice by school districts, support for educational change by parents and legislators, and willingness to change and grow by individual teachers.

For all students, a positive attitude toward mathematics will be a critical condition. This positive attitude must be generated by the general attitude and behavior of teachers. Indeed, all students do not need the same mathematics program, nor do they require the same time in learning a skill; but all students should have a good feeling about mathematics and be aware of its important uses in their lives and its valuable function in the world at large.

One of the most difficult challenges for teachers is to prepare their students for vocations which are presently unknown or not even conceptualized. The students of the next decade will be receiving an education which will be the foundation of their successful work effort in the next century. Thus, the incorporation of computer education in mathematics instruction is essential. This Guide will promote such preparation for a future which can only be conjectured (see Appendix A).

PROFESSIONAL INSERVICE AS A COMPONENT

The implication is that instructional alternatives and new skills will be required of teachers in the present and in the future. In this Guide we have restated and reemphasized curricular goals. To accomplish these goals, we will need provisions for ongoing inservice by schools, support of educational change by parents and legislators, and a willingness to change and grow by individual teachers.

In a busy exciting world, teachers are and will be competing for students' attention. The teacher must, therefore, be a well-prepared practitioner who presents ideas with clarity, interesting delivery, and motivating style. With the proliferation of factual data, teachers must be able to locate resources effectively.

The mathematics community needs to build understanding of mathematics and to develop language as the basis for such understanding; strategies for teaching mathematics must be changed to match the way children learn. The scope and sequence of a curriculum that "weeds out" too many students must also be revised. There are ways for all students to learn more mathematics successfully and to develop higher cognitive skills, and we must work with inservice and research to find them. Research and inservice require funding. Legislators, school board members, and the society at large must respond affirmatively!

INDIVIDUAL AND GROUP COOPERATION AS ESSENTIALS

To use this Guide, teachers must be sensitive to the needs of their students and they must be dedicated to the improvement of student learning as their primary professional objective. The rights of students and parents to expect this dedication has correlative responsibilities: a mutual respect and support by the parents of the educational program and a teacher's professional competence, and the acceptance by the student of ultimate personal and active commitment to his/her own learning.

Prominent educators and other social scientists remind us that change is accomplished by individuals not by institutions and that change is a process not an event. Change comes from a growth in skills and feelings. Novel ideas, new curriclum, and fresh strategies are implemented successfully by teachers who have discussed, planned and supported them. The implications for expanded skills, efficient teaching, and flexible programs will be effected informally by dedicated teachers who have shared in the planning for the curriculum of the future.

The professional community and society share a common goal: To bring all citizens to the full realization of their mathematical capacity. This is a complex and delicate task, and it requires the commitment and cooperation of all segments of society. North Dakotans, an independent and self-reliant component of the national and international environment, have, with the Guide, created a tool for learner accomplishment and a societal vehicle for the pursuit of educational excellence.

Dr. Harold Bergquist
Consultant to the North Dakota
Department of Public Instruction

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INTRODUCTION TO THE ELEMENTARY CURRICULUM

The North Dakota Elementary Mathematics Guide was revised using a prescriptive approach toward instruction and assessment to assist local schools and classroom teachers to develop an effective mathematics curriculum. The Guide should act as a liaison between the statewide perception of curricular needs and needs identified by local schools.

The Guide provides three sections that should help the local schools more clearly identify their needs, philosophies and goals for mathematics education. In one section, specific objectives developed by the North Dakota Mathematics Committee are presented to give an overview of perceived statewide mathematics objectives. Two additional sections summarize the National Council of Supervisors of Mathematics (NCSM) Position Paper on Basic Skills and the National Council of Teachers of Mathematics (NCTM) Agenda for Action which give a national perspective to mathematics goals and philosophies. These sections provide both a state and national overview of mathematics that should be useful to local schools in developing mathematics curricula to meet their needs.

The Scope and Sequence section relates the specific objectives to specific grade levels. This relationship in conjunction with the textbook selection forms included in the appendices should be beneficial to the schools as an aid in textbook selection. In addition, this section provides the classroom teacher with a sequential development of mathematics skills from one grade to another. Another section relates each objective to a test question. This will clarify the objectives while helping the classroom teacher to formulate exercises that will evaluate the student's achievement of a particular skill.

Because of the great impact that technology has had on society as well as mathematics, a section addressing the use of the calculator and a separate section on the use of the computer in the classroom have been added to the Guide. An attempt has been made to give some insight into how the computer and calculator can be used effectively in the classroom to improve instruction. In addition, a form has been included to provide a set of guidelines that will aid the schools in choosing appropriate software. A separate section dealing with the use of the calculator in the classroom is also included. The use of the calculator has not been dealt with as an isolated topic in the Guide, but rather, it has been integrated into the curriculum as a computational aid.

Finally, the Bibliography provides an extensive list of resource material for further clarification and expansion of objectives and other topics discussed in the Guide. Although not exhaustive, the Bibliography along with A Guide for Curriculum Planning K-12* should provide a firm foundation for additional help.

*A Guide for Curriculum Planning K-12, 4th ed. (DPI, 1983)

SCOPE AND SEQUENCE OF SKILLS K-8

		K	1	2	3	4	5	6	7	8
NUMERATION										
	Numbers	*	*	*	*	*	*	*	*	*
	Comparing	*	*	*	*	*	*	*	*	*
	Ordering	*	*	*	*	*	*	*	*	*
	Counting		*	*	*	*	*	*	*	*
	Place value		*	*	*	*	*	*	*	*
	Rounding				*	*	*	*	*	*
	Factors				*	*	*	*	*	*
	Multiples					*	*	*	*	*
WHOLE NUMBER	ADDITION									
	Meaning	*	*	*	*	*	*	*	*	*
	Basic facts		*	*	*	*	*	*	*	*
	Add, no renaming		*	*	*	*	*	*	*	*
	Add, 1 renaming		*	*	*	*	*	*	*	*
	Add, 3 or more addends		*	*	*	*	*	*	*	*
	Add, more than 1 renaming				*	*	*	*	*	*
WHOLE NUMBER	SUBTRACTION									
	Meaning	*	*	*	*	*	*	*	*	*
	Basic facts		*	*	*	*	*	*	*	*
	Subtract, no renaming		*	*	*	*	*	*	*	*
	Subtract, 1 renaming		*	*	*	*	*	*	*	*
	Subtract, more than 1 renaming				*	*	*	*	*	*
WHOLE NUMBER	MULTIPLICATION									
	Meaning			*	*	*	*	*	*	*
	Basic facts			*	*	*	*	*	*	*
	Factors				*	*	*	*	*	*
	Multiplying by a 1-digit factor				*	*	*	*	*	*
	Multiplying by a 2-digit factor					*	*	*	*	*
	Multiples					*	*	*	*	*
	Multiplying by a 3-digit factor						*	*	*	*
	Least common multiple							*	*	*
	Greatest common factor							*	*	*
WHOLE NUMBER	DIVISION									
	Meaning				*	*	*	*	*	*
	Basic facts				*	*	*	*	*	*
	1-digit divisor, 1-digit quotient				*	*	*	*	*	*
	1-digit divisor, 2-digit quotient				*	*	*	*	*	*
	2-digit divisor, 1-digit quotient					*	*	*	*	*
	2-digit divisor, 2-digit quotient					*	*	*	*	*
	2-digit divisor, 3-digit quotient						*	*	*	*
DECIMALS										
	Place value, tenths, hundredths				*	*	*	*	*	*
	Fractions and decimals				*	*	*	*	*	*
	Place value, thousandths						*	*	*	*
	Changing fractions to decimals						*	*	*	*
	Repeating decimals						*	*	*	*
	Place value, millionths							*	*	*
	Percents and decimals							*	*	*

		K	1	2	3	4	5	6	7	8
DECIMAL COMPUTATION										
	Adding					*	*	*	*	*
	Subtracting					*	*	*	*	*
	Multiplying by a whole number						*	*	*	*
	Multiplying by a decimal						*	*	*	*
	Multiplying by a power of 10						*	*	*	*
	Estimating products/quotients						*	*	*	*
	Dividing by a decimal							*	*	*
ESTIMATION										
	Estimating measurements				*	*	*	*	*	*
	Estimating whole number sums/ differences				*	*	*	*	*	*
	Estimating whole number products/ quotients					*	*	*	*	*
	Estimating decimal sums/ differences						*	*	*	*
	Estimating decimal products/ quotients						*	*	*	*
FRACTIONS AND MIXED NUMBERS										
	Part of a whole	*	*	*	*	*	*	*	*	*
	Fractions in measurement			*	*	*	*	*	*	*
	Fractions and decimals				*	*	*	*	*	*
	Meaning of mixed numbers					*	*	*	*	*
	Mixed numbers as quotients						*	*	*	*
	Mixed numbers as improper fractions						*	*	*	*
	Least common denominator						*	*	*	*
	Fractions and percents							*	*	*
FRACTION AND MIXED NUMBER COMPUTATION										
	Adding fractions					*	*	*	*	*
	Subtracting fractions					*	*	*	*	*
	Adding mixed numbers						*	*	*	*
	Subtracting mixed numbers						*	*	*	*
	Multiplying fractions and mixed numbers						*	*	*	*
	Dividing fractions and mixed numbers							*	*	*
MEASUREMENT, TIME, AND MONEY										
Measurement	Perimeter	*	*	*	*	*	*	*	*	*
	Area	*	*	*	*	*	*	*	*	*
	Metric units of measurement		*	*	*	*	*	*	*	*
	Customary units of measurement		*	*	*	*	*	*	*	*
	Volume			*	*	*	*	*	*	*
Time	Time	*	*	*	*	*	*	*	*	*
	Calendar	*	*	*	*	*	*	*	*	*
Money	Penny, nickel, and dime	*	*	*	*	*	*	*	*	*
	Quarter		*	*	*	*	*	*	*	*
	Half-dollar and dollar			*	*	*	*	*	*	*
	Adding and subtracting money			*	*	*	*	*	*	*
	Multiplying and dividing money					*	*	*	*	*

		K	1	2	3	4	5	6	7	8
GEOMETRY										
	Circles	*	*	*	*	*	*	*	*	*
	Polygons	*	*	*	*	*	*	*	*	*
	Three-dimensional shapes	*	*	*	*	*	*	*	*	*
	Congruence	*	*	*	*	*	*	*	*	*
	Symmetry		*	*	*	*	*	*	*	*
	Angles				*	*	*	*	*	*
	Points, lines, segments					*	*	*	*	*
	Parallel and intersecting lines					*	*	*	*	*
	Rays and perpendicular lines						*	*	*	*
GRAPHING, STATISTICS, AND PROBABILITY										
Graphing	Bar graphs/pictographs		*	*	*	*	*	*	*	*
	Ordered pairs			*	*	*	*	*	*	*
	Broken-line graphs					*	*	*	*	*
	Line graphs					*	*	*	*	*
Statistics	Use a graph		*	*	*	*	*	*	*	*
	Averages					*	*	*	*	*
	Mean, median, mode								*	*
Probability	Recording outcomes		*	*	*	*	*	*	*	*
	Listing possible outcomes					*	*	*	*	*
	Probability experiments						*	*	*	*
EQUATIONS, EXPRESSIONS, POSITIVE AND NEGATIVE NUMBERS										
Equations and Expressions	Write a number sentence/equation		*	*	*	*	*	*	*	*
	Missing addends				*	*	*	*	*	*
	Missing factors				*	*	*	*	*	*
	Order of operations							*	*	*
	Inequalities								*	*
Positive and Negative Numbers	Meaning							*	*	*
	Comparing and ordering							*	*	*
	Adding and subtracting							*	*	*
	Multiplying and dividing								*	*
RATIO AND PROPORTION										
	Meaning						*	*	*	*
	Equal ratios						*	*	*	*
	Solving proportions						*	*	*	*
PERCENT										
	Meaning						*	*	*	*
	Percents and decimals						*	*	*	*
	Percents and fractions						*	*	*	*
	Finding a percent of a number						*	*	*	*
PROBLEM SOLVING										
	Solve problems with too much information	*	*	*	*	*	*	*	*	*
	Choose the operation		*	*	*	*	*	*	*	*
	Give sensible answers				*	*	*	*	*	*

OBJECTIVES K-8

KINDERGARTEN

Spatial Relations

K-1 Understand meaning of above and below, top and bottom, up and down.

K-2 Understand meaning of left and right.

Classifying

K-3 Describe likeness of objects in terms of identity, size, color, and shape.

K-4 Describe likeness of objects in terms of use or other attributes.

Numbers and Numeration

K-5 Practice one-to-one matching.

K-6 Identify numbers through 10. (Use a calculator.)

Comparing

K-7 Understand the meaning of taller and shorter, larger and smaller, longer and shorter.

K-8 Understand the meaning of as many as, more than, fewer than, one more than.

Ordering

K-9 Order objects or sets by height, length, size; more or fewer numbers.

K-10 Develop readiness for number line.

K-11 Give the number names in order 1-10.

Shape

K-12 Identify circle.

K-13 Identify triangle, rectangle, square.

Whole Number Operations

K-14 Develop meaning of addition.

K-15 Develop meaning of subtraction.

K-16 Add the basic facts with sums 2 through 6.

Refer to pages II-1 for sample test questions.

GRADE 1

The Numbers 0 Through 6

1-1 Match the number 1, 2, 3, or 4 and the appropriate group.

1-2 Identify sets of 0 through 6.

1-3 Solve problems by using pictures that contain too much information.

Addition Facts Through 6

1-4 Show the meaning of addition by telling how many there are to begin with, how many are joining, and how many there are in all.

1-5 Complete an addition sentence for a joining action.

1-6 Complete addition sentences involving sums of 2 through 6.

1-7 Give answers to addition facts written in vertical form when the facts include 0 as addends and sums of 0 through 6.

1-8 Solve problems by using pictures that involve addition facts through 6.

1-9 Solve problems by continuing patterns.

1-10 Use an ordinal number, first through sixth to describe a position.

1-11 Put a sequence of pictured events in order.

The Numbers 7 Through 12

1-12 Identify sets through 12.

1-13 Order the numbers 1 through 12.

1-14 Identify which of two numbers, 0 through 12, is greater.

Addition Facts for 7 Through 12

1-15 Give answers to addition facts through 12.

1-16 Identify addition names for a given number.

1-17 Solve problems by writing number sentences involving addition facts through 12.

Refer to pages II-5 for sample test questions.

Measurement

1-18 Tell which object is the shortest when the objects have the same baseline.

1-19 Use nonstandard units of measure to determine length or height.

1-20 Use the inch as a unit of measure.

1-21 Use an inch ruler.

1-22 Use a cup, a pint, and a quart as units of measure.

1-23 Use the centimeter as a unit of measure.

1-24 Use a centimeter ruler.

1-25 Use the liter as a unit of measure.

Subtraction Facts Through 8

1-26 Show the meaning of subtraction by telling how many there are to begin with, how many are going away, and how many are left.

1-27 Give answers to subtraction facts that are written in vertical form and that include minuends of 0 through 8.

1-28 Give answers to subtraction facts through 8.

1-29 Solve problems by writing number sentences involving subtraction facts through 8.

Subtraction and Addition Facts for 9 Through 12

1-30 Give answers to addition and subtraction facts through 12.

1-31 Solve problems by deciding whether to add or subtract.

1-32 Illustrate addition and subtraction facts using a calculator.

Numbers and Place Value to 100

1-33 Give the numbers 10 through 19 in standard form.

1-34 Identify which of two numbers, 0 to 100, is greater.

1-35 Identify which of two numbers, 0 to 100, is less.

Counting, Money, Time

1-36 Count by twos.

1-37 Count by fives.

1-38 Count by tens.

1-39 Identify dimes, nickels, and pennies.

1-40 Identify the hour using the digital clock.

Geometry and Fractions

1-41 Identify objects that have the same shape.

1-42 Identify circles, rectangles, squares, and triangles.

1-43 Determine if a shape is divided into equal parts.

Addition and Subtraction Facts for 13 Through 18

1-44 Add or subtract money expressed with the cent sign.

1-45 Give answers to addition and subtraction facts through 18.

1-46 Solve problems by deciding to add or subtract.

Addition Computation

1-47 Add three numbers with sums of 18 or less.

1-48 Solve problems by adding three numbers.

1-49 Add three numbers using a calculator.

GRADE 2

Numbers and Addition Facts Through 10

2-1 Identify sets 0 through 10.

2-2 Give answers to addition facts through 10.

2-3 Solve problems by continuing a pattern.

2-4 Use an ordinal number, first through tenth, to describe a position.

2-5 Put a sequence of pictured events in order.

Numbers and Addition Facts Through 18

2-6 Identify sets of 10 through 18.

2-7 Give the numbers through 18 in standard form.

2-8 Give two numbers through 18, identify which is greater and which is less.

2-9 Give answers to addition facts through 18.

2-10 Solve problems by writing number sentences involving addition facts through 18.

2-11 Add three numbers with sums of 18 or less.

2-12 Illustrate addition and subtraction facts using a calculator.

Measurement

2-13 Use nonstandard units of measure to determine length and height.

2-14 Use the inch as a unit of measure.

2-15 Use an inch ruler.

2-16 Use a cup, a pint, a quart, and a gallon as units of measure.

2-17 Use the centimeter as a unit of measure.

2-18 Use a centimeter ruler.

2-19 Solve problems by using tables.

Refer to pages II-13 for sample test questions.

Subtraction Facts Through 18

2-20 Give answers to subtraction facts through 18, including facts involving zero.

2-21 Solve problems by writing number sentences involving subtraction facts through 18.

2-22 Solve problems by using pictures that involve subtraction facts through 18.

2-23 Complete related sentences for addition and subtraction facts through 18.

2-24 Solve problems by deciding whether to add or subtract.

Place Value, Numbers to 100

2-25 Identify groups of ten and give the decade numbers in standard form.

2-26 Give the number of tens and ones and write the numbers through 99 in standard form.

2-27 Give the numbers through 99 in standard form.

2-28 Given two numbers through 99, identify which is greater or less.

2-29 Solve problems by reading thermometers and scales.

Counting, Money, Time

2-30 Count by twos.

2-31 Count by fives.

2-32 Count by tens.

2-33 Give the value of a group of dimes, nickels, and pennies.

2-34 Give the value of a group of coins that includes one quarter.

2-35 Solve problems involving money.

2-36 Tell time, using standard and digital clocks, to the hour and to the half hour.

Addition Computation

2-37 Add decade numbers with sums through 90.

2-38 Rename more than nine ones as a ten and ones.

2-39 Given numbers of dimes and pennies in place-value boxes, add with or without renaming.

2-40 Given two or three numbers in standard form, add with or without renaming.

2-41 Solve problems by using bar graphs.

2-42 Solve problems with too much information.

Subtraction Computation

2-43 Subtract decade numbers less than 100.

2-44 Rename tens and ones in preparation for subtraction with renaming.

2-45 Decide if it is necessary to rename and show the renaming.

2-46 Given numbers of dimes and pennies in place-value boxes, subtract with or without renaming.

2-47 Given two numbers in standard form, add or subtract with or without renaming.

2-48 Solve problems by deciding whether to add or subtract.

Geometry and Fractions

2-49 Identify objects that have the same shape.

2-50 Identify circles, rectangles, squares, and triangles.

2-51 Identify sides, corners, and square corners.

2-52 Identify a fraction for part of a whole.

2-53 Identify a fraction for part of a set.

Multiplication Facts Through 27

2-54 Relate multiplication and repeated addition.

2-55 Give a multiplication fact for a repeated addition fact.

2-56 Solve problems by choosing addition, subtraction, or multiplication facts.

Place Value and Computation: Three-Digit Numbers

2-57 Write the standard form for a number less than 1,000.

2-58 Identify the number of pennies, nickles, dimes, quarters, and half-dollars.

2-59 Decide which of two numbers is greater or less.

GRADE 3

Addition and Subtraction Facts

3-1 Identify and write ordinal numbers.

3-2 Compare numbers less than 100 using > or < .

3-3 Order numbers less than 100.

3-4 Write sums for addition facts through 18.

3-5 Write differences for subtraction facts through 18.

3-6 Solve problems by choosing addition or subtraction facts.

Numbers and Place Value

3-7 Write numbers and give the place value for any digit in a number through 999.

3-8 Compare numbers less than 1000 using > and < .

3-9 Round numbers to the nearest ten.

3-10 Count by twos, fives, and tens.

3-11 Write numbers and give the place value for any digit in a number through 9,999.

3-12 Choose sensible answers to problems.

Addition

3-13 Add two numbers with up to three digits renaming ones as tens.

3-14 Add two numbers with up to three digits renaming tens as hundreds.

3-15 Add three or more numbers. (Work some problems using a calculator.)

3-16 Estimate the sum of two numbers.

3-17 Solve problems with too much information.

Refer to pages II-23 for sample test questions.

Subtraction

3-18 Subtract numbers with up to three digits renaming tens as ones.

3-19 Subtract numbers with up to three digits renaming hundreds as tens.

3-20 Estimate the difference of two numbers.

3-21 Check subtraction by adding.

3-22 Solve problems by writing number sentences involving additon and subtraction.

Time and Money

3-23 Tell time to the nearest minute using standard and digital clocks.

3-24 Tell time to the nearest five minutes using standard and digital clocks.

3-25 Tell time to the nearest fifteen minutes using standard and digital clocks.

3-26 Read and interpret a calendar for a month.

3-27 Read and interpret a calendar for a year.

3-28 Solve problems by using a table.

3-29 Use the dollar sign and the decimal point to record amounts of money involving pennies, nickels, dimes, quarters, half-dollars, and dollars.

3-30 Add or subtract amounts of money.

3-31 Find amounts of change.

3-32 Choose sensible answers to problems.

Multiplication Facts

3-33 Solve problems by choosing addition, subtraction, or multiplication facts.

3-34 Write products for multiplication facts using 0 through 9 as factors.

3-35 Solve problems by finding patterns.

Multiplication

3-36 Multiply a number by 10 or 100.

3-37 Multiply a two- or a three-digit number by a one-digit number with no renaming.

3-38 Multiply a two-digit number by a one-digit number with renaming from ones to tens.

3-39 Multiply a two-digit number by a one-digit number to get a three-digit product. (Work some problems using a calculator.)

3-40 Solve problems by writing number sentences involving multiplication.

3-41 Solve problems with too much information.

Measurement

3-42 Measure objects to the nearest centimeter.

3-43 Choose an appropriate measure of length using centimeter, meter, or kilometer.

3-44 Choose an appropriate unit of weight (mass) using gram or kilogram.

3-45 Choose an appropriate unit of capacity using milliliter or liter.

3-46 Measure objects to the nearest inch.

3-47 Choose an appropriate unit of length using inch, foot, yard, or mile.

3-48 Choose an appropriate unit of weight using ounce or pound.

3-49 Choose an appropriate unit of capacity using cup, pint, quart, or gallon.

Division Facts

3-50 Complete division sentences.

3-51 Solve problems by choosing addition, subtraction, multiplication, or division facts.

3-52 Write quotients for division facts using 2 through 9 as the divisor.

3-53 Write quotients for division facts involving 0 and 1.

Division

3-54 Identify multiplication and division sentences that belong to a family of facts.

3-55 Use division to find the number in each group or the number of groups.

3-56 Divide a two-digit number by a one-digit number to get a one-digit quotient with a remainder.

3-57 Divide a two-digit number by a one-digit number to get a two-digit quotient with no remainder. (Work some problems using a calculator.)

3-58 Solve problems by choosing addition, subtraction, multiplication, or division.

Graphing and Geometry

3-59 Read and interpret bar graphs and pictographs.

3-60 Solve problems by reading bar graphs and pictographs.

3-61 Identify congruent segments and shapes.

3-62 Find areas by counting square centimeters.

3-63 Identify lines of symmetry.

3-64 Identify spheres, rectangular prisms, cubes, and cylinders.

Fractions and Decimals

3-65 Write a fraction for part of a whole.

3-66 Write a fraction for part of a set.

3-67 Write decimals involving money.

GRADE 4

Addition and Subtraction Facts

4-1 Compare and order numbers less than 100 using > and < .

4-2 Write sums for addition facts.

4-3 Write differences for subtraction facts.

4-4 Add three or more one-digit numbers.

4-5 Solve problems by choosing addition or subtraction facts.

Numbers and Place Value

4-6 Write numbers and give the place value for any digit in a number through 9,999.

4-7 Round a number to the nearest ten or nearest hundred.

4-8 Solve problems by using a table.

4-9 Write numbers through 999,999 and give the place value for any digit in a number through 999,999.

4-10 Choose sensible answers to problems.

Addition and Subtraction

4-11 Estimate the sum of two numbers and add numbers with up to four digits with no renaming.

4-12 Add two numbers with up to four digits with more than one renaming.

4-13 Add three or more numbers with up to four digits.

4-14 Subtract numbers with up to four digits with more than one renaming.

4-15 Add or subtract amounts of money.

4-16 Solve problems by writing equations involving addition and subtraction using a calculator where appropriate.

Refer to pages II-31 for sample test questions.

Measurement

4-17 Tell time using standard and digital clocks.

4-18 Read and interpret a calendar.

4-19 Choose an appropriate metric or customary measure for distance, mass, volume, or temperature.

4-20 Solve problems by estimating lengths.

Multiplication Facts

4-21 Write products for multiplication facts using 0 through 9 as factors.

4-22 Write problems using the addition, subtraction, and multiplication operations.

Multiplication

4-23 Multiply a two-, a three-, or a four-digit number and a one-digit number with one renaming.

4-24 Solve problems by finding a pattern.

4-25 Multiply a three- or a four-digit number containing zeros by a one-digit number.

4-26 Multiply numbers that are multiples of 10, 100, or 1,000.

4-27 Estimate the product of two numbers.

4-28 Solve problems by choosing addition, subtraction, or multiplication.

Geometry

4-29 Identify polygons and give the numbers of sides and angles in polygons.

4-30 Identify congruent segments and polygons.

4-31 Find perimeters.

4-32 Find areas by counting square centimeters.

4-33 Identify lines of symmetry.

4-34 Find volumes by counting cubic centimeters.

Division Facts

4-35 Write quotients for division facts involving 0 and 1.

4-36 Write quotients for division facts using 1 through 9 as divisors, and identify multiplication and division sentences that belong to a family of facts.

4-37 Solve multiple-step problems.

4-38 Divide a two-digit number by a one-digit number to get a one digit quotient with a remainder.

4-39 Solve problems by choosing addition, subtraction, multiplication, or division using a calculator where appropriate.

Division

4-40 Divide a two-digit number by a one-digit number to get a two-digit quotient.

4-41 Solve problems by interpreting remainders.

4-42 Find averages.

4-43 Correct one-digit estimates that are too large.

Decimals

4-44 Write decimals involving tenths and hundredths.

4-45 Write decimals and give the place value for any digit in decimals through hundredths.

4-46 Write decimals for amounts of money.

4-47 Solve problems with too much information.

Fractions

4-48 Write a fraction for part of a whole.

4-49 Write a fraction for part of a set.

4-50 Add fractions with the same denominator.

4-51 Subtract fractions with the same denominator.

Graphing

4-52 Read and interpret pictographs.

4-53 Read and interpret bar graphs.

4-54 Identify number pairs for points on a grid and identify points on a grid for number pairs.

4-55 Solve problems by reading graphs.

GRADE 5

Place Value, Addition, and Subtraction

5-1 Write numbers and give the place value for any digit in a number through thousands.

5-2 Compare and order whole numbers.

5-3 Choose sensible answers to problems.

5-4 Round numbers to the nearest ten, nearest hundred, or nearest thousand.

5-5 Write sums and differences for addition and subtraction facts.

5-6 Estimate the sum or difference of two numbers and add or subtract two numbers with up to four digits with no renaming.

5-7 Add two numbers with up to five digits with more than one renaming.

5-8 Add three or more numbers with up to five digits.

5-9 Subtract numbers with up to five digits with more than one renaming.

5-10 Subtract numbers with up to five digits with consecutive renaming involving zeros.

5-11 Solve problems by writing equations involving addition or subtraction.

5-12 Add or subtract amounts of money. (Work some problems using a calculator.)

Multiplication

5-13 Write products for multiplication facts and write multiples of a number.

5-14 Estimate the product of 2 two-digit numbers.

5-15 Multiply 3 one-digit numbers.

5-16 Multiply a two- or a three-digit number by a two-digit number.

5-17 Multiply an amount of money by a whole number.

5-18 Solve problems by choosing addition, subtraction, or multiplication.

Refer to pages II-39 for sample test questions.

Division With One-Digit Divisors

5-19 Write quotients for division facts.

5-20 Divide by a one-digit divisor to get a one-digit quotient.

5-21 Divide by a one-digit divisor to get a two-digit quotient.

5-22 Divide by a one-digit divisor to get a three-digit quotient.

5-23 Divide by a one-digit divisor to get a quotient with one or two zeros.

5-24 Solve problems by writing equations involving addition, subtraction, multiplication, or division.

5-25 Find averages.

5-26 Divide an amount of money by a whole number.

Division With Two-Digit Divisors

5-27 Divide by a two-digit divisor to get a one-digit quotient.

5-28 Round the divisor to make a better estimate for the quotient.

5-29 Divide by a two-digit divisor to get a two-digit quotient.

5-30 Solve problems by interpreting remainders using a calculator where appropriate.

5-31 Solve problems by choosing addition, subtraction, multiplication, or division.

Addition and Subtraction of Decimals

5-32 Write decimals involving tenths, hundredths, and thousandths.

5-33 Write decimals for amounts of money.

5-34 Give the place value for any digit in a decimal through thousandths.

5-35 Add two or more decimals through thousandths.

5-36 Subtract decimals through thousandths.

5-37 Solve problems with too much or too little information.

5-38 Solve problems by choosing addition or subtraction of decimals.

Measurement

5-39 Find perimeters.

5-40 Find volume by counting cubic centimeters.

5-41 Choose an appropriate customary or metric measure for distance, mass, volume, and temperature.

5-42 Solve problems by estimating distances.

Meaning of Fractions

5-43 Write a fraction for part of a whole.

5-44 Write a fraction for part of a set.

5-45 Write equal fractions for pictured situations.

5-46 Write fractions in lowest terms.

5-47 Write mixed numerals for pictured situations.

5-48 Find the least common denominator for two or three fractions.

5-49 Write improper fractions for mixed numbers.

5-50 Write mixed numbers for improper fractions.

Multiplication of Fractions

5-51 Multiply two or three fractions.

5-52 Multiply a fraction and a whole number.

5-53 Solve problems by using tables.

Addition and Subtraction of Fractions

5-54 Add two mixed numbers with the same denominator.

5-55 Add two mixed numbers with the same denominator and rename the sum.

5-56 Add two fractions with different denominators.

5-57 Add two mixed numbers with different denominators.

5-58 Subtract fractions or mixed numbers with the same denominator.

5-59 Subtract fractions with different denominators.

Geometry

5-60 Identify points, lines, segments, rays, intersecting lines, and parallel lines.

5-61 Give measures of angles by using a protractor.

5-62 Identify center, radius, and diameter of a circle.

5-63 Identify triangles, parallelograms, rectangles, squares, pentagons, hexagons, and octagons.

5-64 Find lines of symmetry.

5-65 Identify congruent segments and figures.

Graphing and Ratio

5-66 Read and interpret pictographs.

5-67 Read and interpret bar graphs.

5-68 Identify number pairs for points on a grid and identify points on a grid for number pairs.

5-69 Solve problems by reading graphs.

GRADE 6

Addition and Subtraction of Whole Numbers

6-1 Write numbers and give the place value for any digit in a number through hundred-thousand.

6-2 Compare and order whole numbers.

6-3 Round numbers to the nearest hundred, nearest thousand, or nearest ten-thousand.

6-4 Estimate sums and differences by using rounded numbers.

6-5 Add two or three numbers with up to six digits, with more than one renaming.

6-6 Subtract numbers with up to six digits, with more than one renaming.

6-7 Solve problems by choosing addition or subtraction.

6-8 Solve problems by writing equations involving addition or subtraction.

Multiplication of Whole Numbers

6-9 Write products for multiplication facts and write pairs of related multiplication facts.

6-10 Estimate the product of 2 or 3 two-digit numbers.

6-11 Multiply a two-, a three-, or a four-digit number by a multiple of 10.

6-12 Multiply a two-, a three-, a four-, or a five-digit number by a two-digit multiplier.

6-13 Solve problems by choosing addition, subtraction, or multiplication.

6-14 Write multiples of numbers to find the least common multiple of two numbers.

6-15 Solve problems by finding patterns.

Refer to pages II-49 for sample test questions.

Division of Whole Numbers

6-16 Find the average for a given set of numbers.

6-17 Solve problems by interpreting remainders.

6-18 Round the dividend and the divisor to make better estimates of quotients.

6-19 Divide by a two-digit divisor to get a quotient with three or more digits.

6-20 Solve problems by choosing addition, subtraction, multiplication, or division.

6-21 Solve problems by writing equations involving addition, subtraction, multiplication, or division.

6-22 Write the factors of a number and find the greatest common factor of two numbers.

6-23 Tell whether a number is prime or composite, use a calculator to help you decide.

Addition and Subtraction of Decimals

6-24 Write decimals involving tenths, hundredths, and thousandths.

6-25 Give the place value for any digit in a decimal through millionths and count decimal places through millionths.

6-26 Write decimals in tenths, hundredths, or thousandths and compare and order decimals through thousandths.

6-27 Round a decimal to the nearest one, tenth, hundredth, or thousandth.

6-28 Add two or more decimals through thousandths.

6-29 Subtract decimals through thousandths.

6-30 Solve problems by using a table.

6-31 Solve problems involving money.

Multiplication and Division of Decimals

6-32 Multiply a whole number or a decimal by a decimal.

6-33 Multiply decimals involving zeros in the product.

6-34 Solve multiple-step problems involving addition, subtraction, multiplication, or division of decimals. (Use a calcuator where appropriate.)

6-35 Divide a decimal by a whole number.

6-36 Divide a decimal by a decimal.

6-37 Round the quotient of two decimals to a given number of places.

6-38 Solve problems involving money.

Measurement

6-39 Choose an appropriate customary or metric measure for distance, area, mass, volume, and temperature.

6-40 Solve problems by choosing sensible answers involving measures.

Meaning of Fractions

6-41 Write a fraction for part of a whole or part of a set.

6-42 Write a fraction in lowest terms.

6-43 Find the least common denominator for two or more fractions and rewrite fractions with the least common denominator.

6-44 Compare and order fractions.

6-45 Write a mixed number for a pictured situation or a phrase and compare mixed numbers.

6-46 Write an improper fraction for a whole number or a mixed number and write a mixed number or a whole number for an improper fraction.

6-47 Write a decimal for a fraction and a fraction for a decimal.

Multiplication and Division of Fractions

6-48 Multiply fractions, mixed numbers, and whole numbers.

6-49 Use a shortcut to multiply fractions and mixed numbers.

6-50 Solve problems involving too much or too little information.

6-51 Divide fractions, mixed numbers, and whole numbers.

Addition and Subtraction of Fractions

6-52 Add two or more fractions with different denominators.

6-53 Add mixed numbers with different denominators.

6-54 Subtract mixed numbers and fractions with the same denominator by using renaming.

6-55 Subtract mixed numbers and fractions with different denominators.

6-56 Subtract mixed numbers with different denominators by using renaming.

6-57 Solve problems by choosing addition, subtraction, multiplication, or division of fractions and mixed numbers.

Geometry

6-58 Identify angles by their measures, then measure and draw angles of a given measure by using a protractor.

6-59 Measure the angles of a triangle, classify triangles by their angle measures, and find missing angle measures.

6-60 Find the perimeter of a polygon.

6-61 Find the area of a rectangle and the area of a triangle.

6-62 Find the circumference of a circle.

6-63 Identify prisms and pyramids and count faces, vertices, and edges of polyhedrons.

6-64 Find the volume of a prism.

6-65 Use formulas to solve problems involving circumference, area, and volume using a calculator where appropriate.

Ratio, Proportion, and Percent

6-66 Write ratios for rates and comparisons and complete lists of equal ratios.

6-67 Find cross-products and tell whether two ratios form a proportion.

6-68 Use cross-products to solve proportions.

6-69 Use proportions to solve problems.

6-70 Write a decimal as a percent and a percent as a decimal.

6-71 Write a fraction as a percent and a percent as a fraction.

6-72 Use a decimal to find a percent of a number.

6-73 Use a fraction to find a percent of a number.

6-74 Solve multiple-step problems involving sales tax using a calculator.

6-75 Write an equation to find a percent or to find a percent of a number.

Graphing

6-76 Read and interpret circle graphs.

6-77 Identify a number pair for a point on a grid and locate a point on a grid for a number pair.

6-78 Read and interpret a line graph.

6-79 Solve problems by reading graphs.

GRADE 7

Addition and Subtraction of Whole Numbers

7-1 Write numbers and give the place value for any digit in a number through trillions.

7-2 Compare and order whole numbers.

7-3 Round numbers to the nearest ten, nearest hundred, nearest thousand, nearest ten-thousand, nearest hundred-thousand, and nearest million.

7-4 Estimate the sum or the difference of two numbers.

7-5 Add two or more numbers, with up to six digits, with one or more renamings.

7-6 Subtract two numbers, with up to six digits, and with one or more renamings.

7-7 Solve problems by writing equations involving addition and subtraction.

7-8 Solve problems with too much or too little information.

Multiplication and Division of Whole Numbers

7-9 Estimate the product of two numbers.

7-10 Multiply a two-, a three-, or a four-digit number by a two- or a three-digit multiplier.

7-11 Divide by a two-digit divisor to get a quotient with up to four digits.

7-12 Divide by a three-digit divisor to get a quotient with up to three digits.

7-13 Solve problems by choosing addition, subtraction, multiplication, or division using a calculator where appropriate.

7-14 Solve multiple-step problems using a calculator where appropriate.

7-15 Use the standard order of operations to evaluate an expression involving more than one operation.

Refer to pages II-59 for sample test questions.

7-16 Use the properties of addition and multiplication to evaluate expressions.

7-17 Solve problems by writing equations involving addition, subtraction, multiplication, or division before computing.

Number Theory

7-18 Use rules for divisibility by 2, 3, 5, 9, or 10.

7-19 List the factors of a number and write products involving exponents in standard form.

7-20 Tell whether a number is prime or composite.

7-21 Make factor trees and write a number as a product of its prime factors.

7-22 Find common factors and the greatest common factor of a pair of numbers by listing factors or by using prime factorization.

7-23 Find the least common multiple of two numbers by listing multiples or by using prime factorization.

Decimals

7-24 Write decimals and give the place value for any digit in a decimal through millionths.

7-25 Compare and order decimals.

7-26 Round a decimal to the nearest one, nearest tenth, nearest hundredth, or nearest thousandth.

7-27 Add or subtract decimals through thousandths.

7-28 Multiply decimals that require additional zeros in the product.

7-29 Estimate the product of two decimals.

7-30 Divide a decimal by a whole number.

7-31 Solve an addition or a subtraction equation involving decimals.

7-32 Solve a multiplication or a division equation involving decimals using a calculator where appropriate.

Multiplication and Division of Fractions

7-33 Write a fraction for part of a whole, part of a set, or a quotient.

7-34 Write equal fractions and fractions in lowest terms.

7-35 Use common denominators to compare and order fractions.

7-36 Write a mixed number for a pictured situation or a quotient and compare and order mixed numbers.

7-37 Write an improper fraction for a mixed number or a mixed number for an improper fraction.

7-38 Write a decimal for a fraction or a fraction for a decimal.

7-39 Multiply two or more fractions.

7-40 Multiply fractions and mixed numbers.

7-41 Divide a fraction or a mixed number by a fraction.

7-42 Divide a fraction or a mixed number by a mixed number or a whole number.

7-43 Solve a multiplication equation involving fractions by using a reciprocal.

7-44 Solve problems by using estimation.

Addition and Subtraction of Fractions

7-45 Add fractions, mixed numbers, and whole numbers.

7-46 Subtract fractions, mixed numbers, and whole numbers with renaming.

7-47 Solve problems by choosing addition, subtraction, multiplication, or division of fractions.

7-48 Solve problems by writing equations involving addition, subtraction, multiplication, or division of fractions using a calculator for the computation.

Ratio, Proportion, and Percent

7-49 Write ratios and proportions for rate and comparison situations and tell whether two ratios form a proportion.

7-50 Use cross-products to solve proportions.

7-51 Solve problems involving proportions related to map scales.

7-52 Write percents for decimals and decimals for percents.

7-53 Write percents for fractions and fractions for percents.

7-54 Find a percent of a number by using a decimal or a fraction.

7-55 Solve multiple-step problems using a calculator where appropriate.

7-56 Find what percent one number is of another.

7-57 Solve problems by writing equations involving percents.

Measurement

7-58 Choose the appropriate customary or metric measure of length, area, volume, mass, or capacity.

7-59 Solve problems by choosing sensible answers.

7-60 Measure segments and add or subtract with customary or metric units.

7-61 Add or subtract measures of time and compute elapsed time.

7-62 Solve multiple-step problems.

Geometry

7-63 Identify points, lines, planes, segments, rays, angles, sides, vertices, and endpoints.

7-64 Measure and classify angles as acute, right, or obtuse and draw angles with given measures.

7-65 Sketch and identify parallel, intersecting, and perpendicular lines.

7-66 Identify congruent figures.

7-67 Give the measure of the third angle of a triangle and classify a triangle in terms of its sides or angles.

7-68 Classify a polygon in terms of its sides and angles.

7-69 Identify similar polygons in terms of the measures of corresponding sides and angles.

7-70 Identify center, chord, diameter, radius, arc, and central angle of a circle.

7-71 Identify prisms and pyramids and count faces, vertices, and edges of polyhedrons.

7-72 Solve problems by solving simpler problems. (i.e., look for a pattern for a specific case.)

Perimeter, Area, and Volume

7-73 Find the perimeter of a polygon by using a formula.

7-74 Find the circumference of a circle by using a formula.

7-75 Find the area of a rectangle by using a formula.

7-76 Find the area of a parallelogram and of a triangle by using a formula.

7-77 Find the area of a circle by using a formula.

7-78 Find the area of an irregular figure by using a formula.

7-79 Find the surface area of a polyhedron by adding the areas of its faces.

7-80 Find the surface area of a cylinder by adding the areas of its surfaces.

7-81 Find the volume of a prism by using a formula.

7-82 Find the volume of a cylinder by using a formula.

7-83 Solve problems by using formulas, use a calculator where appropriate.

Statistics and Probability

7-84 Use a frequency table to organize data and determine the range for a set of data.

7-85 Read and construct single and double bar graphs for given sets of data.

7-86 Read and construct broken-line graphs for a given set of data.

7-87 Read and interpret a circle graph.

7-88 Identify the mean, median, and mode for a set of data.

7-89 Solve problems using graphs.

7-90 Find the probability that a given outcome will occur in an experiment.

7-91 Give the expected outcome when a probability is known, use a calculator where appropriate.

Integers and Coordinate Graphing

7-92 Write an integer or its opposite for a given situation.

7-93 Name the integer associated with a point on a number line and compare and order integers.

7-94 Add integers with the same sign.

7-95 Add integers with different signs.

7-96 Subtract integers.

7-97 Multiply integers.

7-98 Divide integers.

7-99 Use the standard order of operations and properties of operations to evaluate an expression involving integers.

7-100 Solve an addition, subtraction, multiplication, or division problem involving integers.

7-101 Locate points with given ordered pairs of integers as coordinates.

7-102 Give the coordinates of points in a graph.

7-103 Complete tables of values and graph linear equations in two variables.

GRADE 8

Whole Numbers and Number Theory

8-1 Write numbers in expanded form and round numbers to a specified place.

8-2 Estimate the sum, difference, or product of two numbers.

8-3 Add or subtract numbers with up to six digits.

8-4 Multiply a two-, a three-, or a four-digit number by a two- or a three-digit multiplier.

8-5 Divide by a two-, or a three-digit divisor to get a quotient with up to three digits.

8-6 Solve problems by choosing addition, subtraction, multiplication, or division.

8-7 Write a product using exponents and write a number as the product of its prime factors.

8-8 Find common factors and the greatest common factor of a pair of numbers by listing factors or by using prime factorization.

8-9 Find the least common multiple of two numbers by listing multiples or by using prime factorization.

Equations and Graphs

8-10 Solve an addition or a subtraction equation by subtracting the same number from both sides or by adding the same number to both sides.

8-11 Solve a multiplication or a division equation by dividing or multiplying both sides by the same number.

8-12 Solve problems by writing equations involving addition, subtraction, multiplication, or division using a calculator for the computation.

8-13 Solve two-step equations.

8-14 Locate points on a grid by using ordered pairs of numbers.

8-15 Solve problems by using graphs.

Refer to pages II-71 for sample test questions.

Decimals

8-16 Write decimals and give the place value for any digit in a decimal through millionths.

8-17 Compare and order decimals.

8-18 Round decimals to the nearest one, nearest tenth, nearest hundredth, nearest thousandth, nearest ten-thousandth, or nearest hundred-thousandth.

8-19 Add or subtract decimals through hundred-thousandths.

8-20 Solve problems with too much or too little information.

8-21 Multiply decimals.

8-22 Divide a decimal by a decimal and round the quotient to a given number of places.

8-23 Solve equations involving decimals.

Fractions

8-24 Write equal fractions and fractions in lowest terms.

8-25 Use common denominators to compare and order fractions.

8-26 Write fractions for decimals and decimals for fractions.

8-27 Multiply two or more fractions.

8-28 Multiply or divide fractions and mixed numbers.

8-29 Add or subtract mixed numbers with renaming.

8-30 Solve an addition, a subtraction, a multiplication, or a division equation involving fractions.

8-31 Solve two-step equations involving fractions.

Ratio, Proportion, and Percent

8-32 Write ratios and proportions for rate and comparison situations and tell whether two ratios form a proportion.

8-33 Solve proportions by using cross-products.

8-34 Solve problems involving proportions.

8-35 Write percents for decimals and decimals for percents.

8-36 Write percents for fractions.

8-37 Write a fraction for a percent, and given a fraction, percent, or decimal, write the other two forms of the number.

8-38 Find a percent of a number by using a percent or a decimal.

8-39 Solve multiple-step problems using a calculator.

8-40 Find what percent one number is of another by division.

8-41 Solve problems involving percents by writing equations.

8-42 Find a number when a percent of it is known.

8-43 Solve problems by using a formula, (using a calculator).

Measurement

8-44 Choose the appropriate customary or metric measure of length, area, volume, mass, or capacity.

8-45 Tell what the unit of measure is for a given measure, give the greatest possible error, and tell which measure is more precise.

Geometry

8-46 Identify complementary and supplementary angles and give the measure of the complement or the supplement of a given angle.

8-47 Identify parallel lines, transversals, and related angle measures.

8-48 Use a compass and a straightedge to construct segments and angles congruent to given segments and angles and to bisect given segments and angles.

8-49 Use a compass and a straightedge to construct a triangle congruent to a given triangle.

8-50 Classify triangles in terms of their sides and angles.

8-51 Classify polygons in terms of their sides and angles.

8-52 Name corresponding parts of congruent polygons and determine lengths of sides and measures of angles in congruent polygons.

8-53 Identify similar polygons and use proportions to find missing lengths in similar polygons.

8-54 Identify prisms, pyramids, cylinders, cones, and spheres.

8-55 Solve problems by solving simpler problems. (i.e., look for a pattern for a specific case.)

Perimeter, Area, and Volume

8-56 Find the perimeter of a polygon.

8-57 Find the area of a rectangle, parallelogram, or triangle by using a formula.

8-58 Find the area of a trapezoid and of an irregular figure by combining areas.

8-59 Find the circumference of a circle by using approximations for π.

8-60 Find the area of a circle by using a formula.

8-61 Solve multiple-step problems using a calculator where appropriate.

8-62 Find the surface area of a polyhedron by adding the areas of its faces.

8-63 Find the surface area of a cylinder or of a cone by using a formula.

8-64 Solve problems by using estimation.

8-65 Find the volume of a prism or of a cylinder by using a formula.

8-66 Find the volume of a pyramid or of a cone by using a formula.

Statistics and Probability

8-67 Use a graph or a table to organize data and determine the range for a set of data.

8-68 Read and construct circle and broken-line graphs for given sets of data.

8-69 Identify the mean, the median, and the mode for a set of data.

8-70 Interpret statistics and graphs.

8-71 Compute the probability that a given outcome will occur.

8-72 Compute probability when events are independent.

8-73 Compute probability when events are dependent.

8-74 Find the probability that a given outcome will occur in an experiment.

8-75 Solve problems by using estimation.

Integers

8-76 Write an integer or its opposite for a given situation.

8-77 Compare and order integers.

8-78 Add integers.

8-79 Subtract integers.

8-80 Multiply integers.

8-81 Divide integers.

8-82 Evaluate an addition, a subtraction, a multiplication, or a division expression for given integral values of the variable.

8-83 Solve multiple-step problems using a calculator where appropriate.

Rational Numbers and Irrational Numbers

8-84 Write rational numbers in fractional form and compare and order rational numbers.

8-85 Add and subtract rational numbers.

8-86 Multiply and divide rational numbers.

8-87 Write numbers given in standard form in exponential form and write numbers given in exponential form in standard form.

8-88 Use scientific notation for large and small numbers.

8-89 Compute with numbers written in scientific notation.

8-90 Decide between which two integers the square root of a number falls and use a table of square roots.

8-91 Classify a real number as rational or irrational.

8-92 Use the Pythagorean Theorem to find the length of the third side of a right triangle.

8-93 Solve problems by using a formula, use a calculator where appropriate.

8-94 Find the tangent for a given angle and use the tangent ratio to find the length of a side of a triangle.

8-95 Solve problems by using diagrams.

Equations, Inequalities, and Graphing

8-96 Solve an addition or a subtraction equation involving rational numbers.

8-97 Use reciprocals to solve a multiplication or a division equation involving rational numbers.

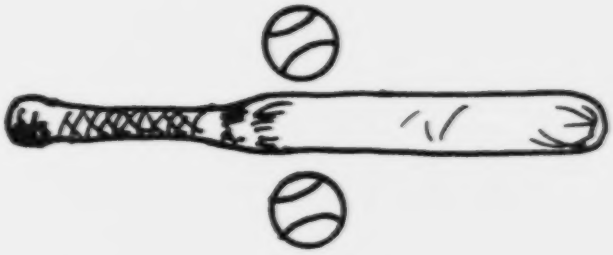
8-98 Graph inequalities on the number line.

8-99 Solve problems by using graphs.

SAMPLE TEST QUESTIONS

Spatial Relations

K-1 Draw an X on the ball above the bat.

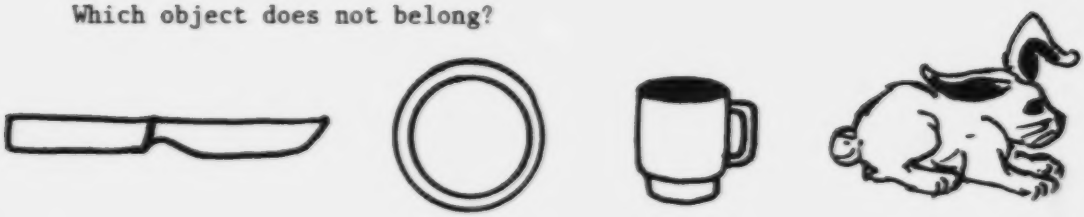


K-2 Color the triangle on the left.

Classifying

K-3 The teacher displays a red triangle and a red rectangle. The children tell how they are alike.

K-4 Which object does not belong?

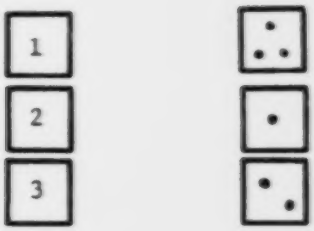


Numbers and Numeration

K-5 Match in a one to one correspondence.

Refer to page I-1 for grade level objectives.

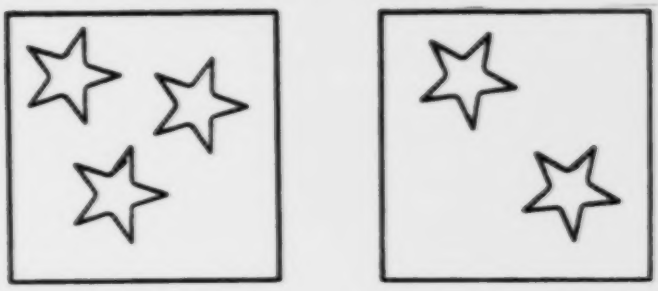
K-6 Match



Comparing

K-7 Color the house that is taller.

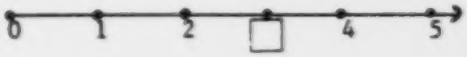
K-8 Draw an X under the box that has fewer stars.



Ordering

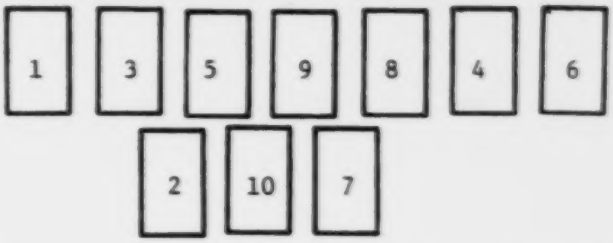
K-9 Give the child 3 objects to place in order from shortest to longest.

K-10 Write the missing number.



K-11 Give the child cards with the numbers 1 through 10.

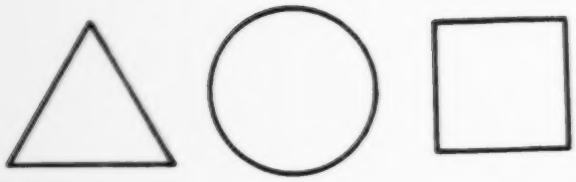
Examples:



The child arranges them in number order - smallest to largest.

Shape

K-12 Color the circle.



K-13 Color the square.

Whole Number Operation

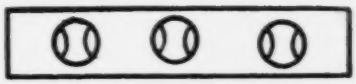
K-14 How many figures all together?

K-15 How many birds are staying?

K-16 Add 1 + 2 = _____

The Numbers 0 Through 6

1-1 How many?

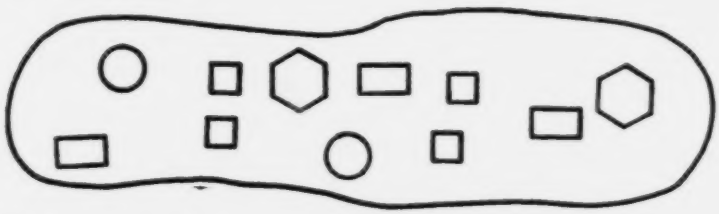


2 4 3 1

1-2 How many cats?

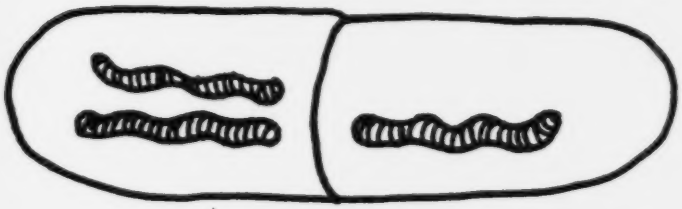
0 1 4 6

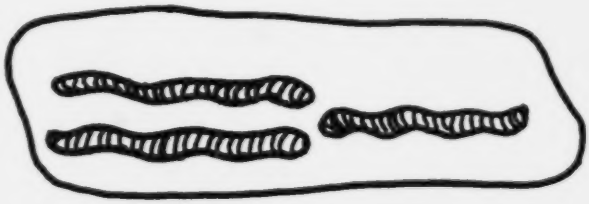
1-3 How many ☐ ?



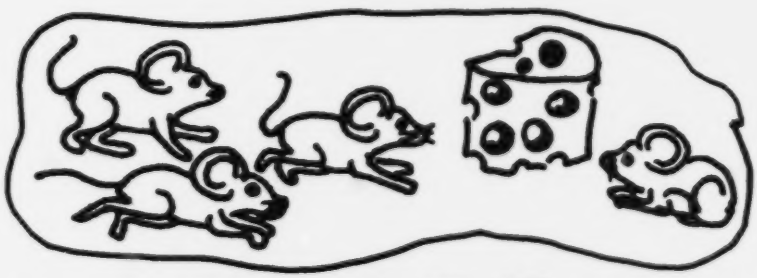
Addition Facts Through 6

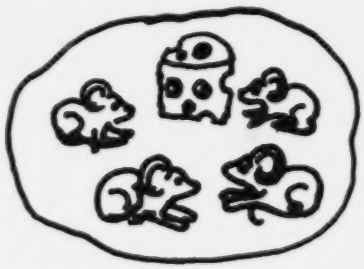
1-4 How many? How many came? How many in all?





1-5 How many mice in each group? How many mice in all?





1-6

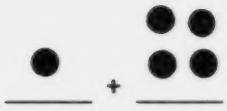
_____ + _____ = _____

Refer to pages I-3 for grade level objectives.

1-7

$$\begin{array}{r} 2 \\ +\ 3 \\ \hline \end{array}$$

1-8



____ + ____ = ____

1-9 What comes next?

1-10 Match positions and words.

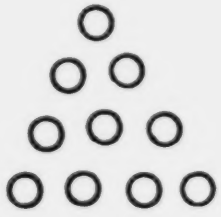
fifth sixth fourth second third first

1-11 Number the pictures in order.

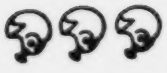
____ ____ ____ ____

The Numbers 7 Through 12

1-12 How many circles?



9 10 11

1-13  Write the number.

Three _____

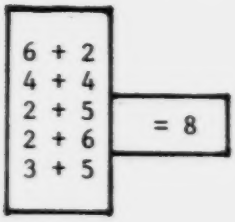
1-14 How many?
Write an X under the group which has more.

_____ _____

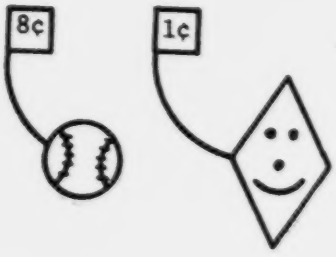
Addition Facts for 7 Through 12

1-15
$$\begin{array}{r} 5 \\ +\ 7 \\ \hline \end{array}$$

1-16 Which problems give the answer?
(Circle the correct problem(s).)



1-17 What is the total cost? Write a number sentence.

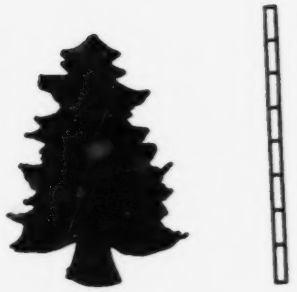


_____ + _____ = _____¢

Measurement

1-18 Which is shortest?

1-19 How many units tall?



1-20 Which is about 1 inch long?

1-21 Use the inch ruler. How long?

_____

1-22 Which container holds the same amount as the first container?

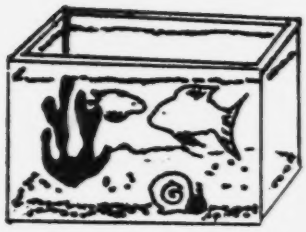
1-23 Which is about 1 centimeter long?

1-24 Use the centimeter ruler. About how many centimeters long?

_____

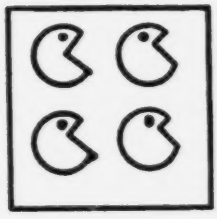
1-25 Which holds 1 liter?

1 liter



Subtraction Facts Through 8

1-26

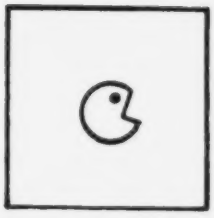


How many?

_____

How many go away?

_____



How many left?

_____

1-27

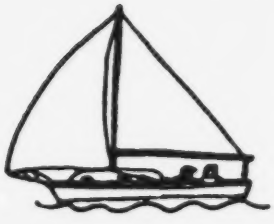
$$\begin{array}{r} 4 \\ -\ 3 \\ \hline \end{array}$$

1-28

$$\begin{array}{r} 8 \\ -\ 5 \\ \hline \end{array}$$

1-29

2¢



3¢

John had 5¢.
He bought the boat. How much money is left? _____ ¢

_____ - _____ = _____

Subtraction and Addition Facts for 0 Through 12

1-30

$$\begin{array}{r} 10 \\ -\ 6 \\ \hline \end{array}$$

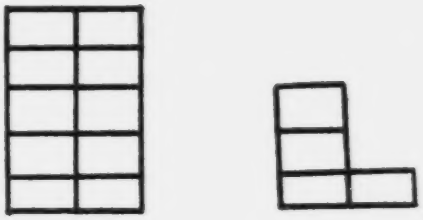
1-31 Give the answer.

Dave had 6 pennies.
He found 6 more.
How many pennies does he have in all?

1-32 Add 3 + 4 using a calculator.

Numbers and Place Value to 100

1-33 How many in all?



1-34 Which is more?

36 or 63

1-35 Which is less?

28 or 31

Counting, Money, Time

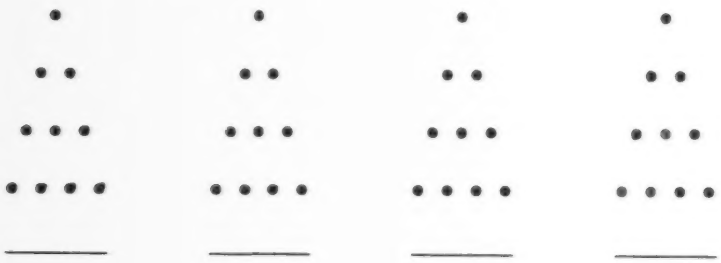
1-36 Count by twos.

_____ _____ _____

1-37 Count by fives.

_____ _____ _____ _____ _____

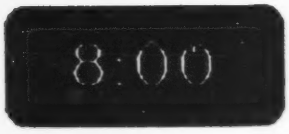
1-38 Count by tens.



_____ _____ _____ _____

1-39 How much money?

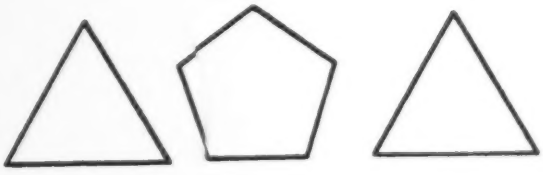
1-40



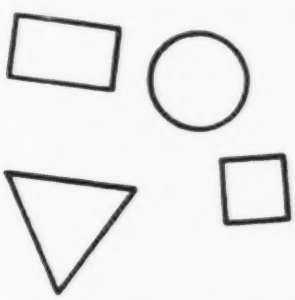
_____ o'clock

Geometry and Fractions

1-41 Which have the same shape?



1-42 Match Shapes and Words

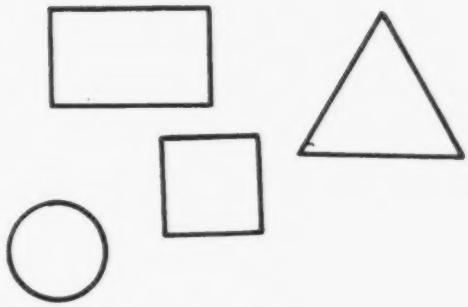


square

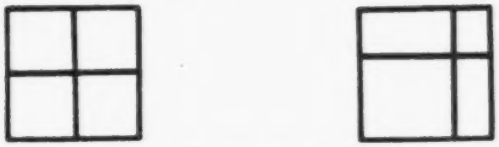
rectangle

triangle

circle



1-43 Which has equal parts?



Addition and Subtraction Facts for 13 Through 18

1-44
$$\begin{array}{r} 6¢ \\ +\ 7¢ \\ \hline \end{array}$$

1-45
$$\begin{array}{r} 17 \\ -\ 8 \\ \hline \end{array}$$

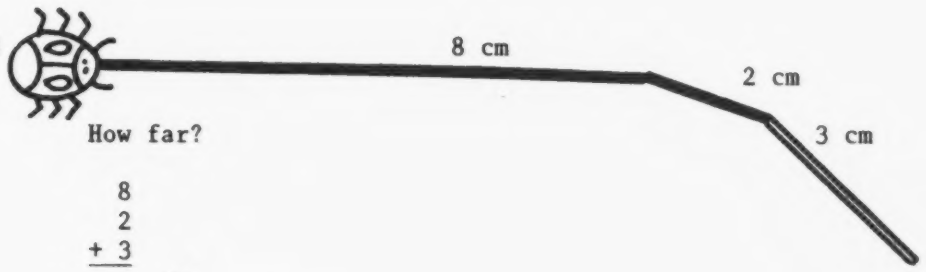
1-46 Do you add (+) or subtract (-)?
Give the answer.

Leona had 9¢.
She found 8¢ more.
How much money does she have in all? _____¢

Addition Computation

1-47
$$\begin{array}{r} 8 \\ 4 \\ +\ 2 \\ \hline \end{array}$$

1-48



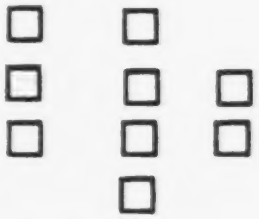
How far?

$$\begin{array}{r} 8 \\ 2 \\ +\ 3 \\ \hline \end{array}$$
cm

1-49 Add 8 + 1 + 3 using a calculator.

Numbers and Addition Facts Through 10

2-1 How many in all?



2-2 Add

$$\begin{array}{r} 8 \\ +\ 2 \\ \hline \end{array}$$

2-3 Copy and continue the pattern.

L S B L S B

___ ___ ___ ___ ___ ___ ___ ___ ___ ___

2-4 Match positions and objects.

third fifth eighth tenth

2-5 Number the pictures in order.

_____ _____ _____

Numbers and Addition Facts Through 18

2-6 Show that many.

13

Refer to pages I-7 for grade level objectives.

2-7 How many dots?

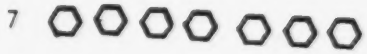
2-8 Which is less?

17 or 12

2-9 Add

$$\begin{array}{r} 8 \\ +\ 9 \\ \hline \end{array}$$

2-10 Write a number sentence to tell how many.



_____

2-11 Add

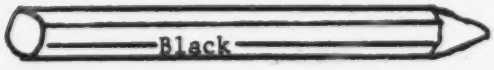
$$\begin{array}{r} 5 \\ 7 \\ +\ 6 \\ \hline \end{array}$$

2-12 Use a calculator to add 3 + 6 + 2.

Measurement

2-13 About how long?

_____ units long.



2-14 About how many inches long?

_____ inches.

2-15 About how many inches long? Use an inch ruler.

_____

2-16 Which container holds the same amount as the cup on the left?

2-17 About how many centimeters long?

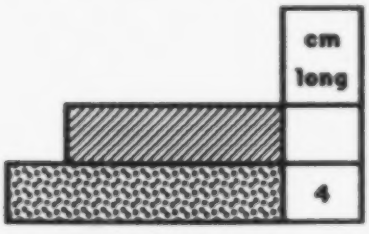
_____ _____ centimeters

centimeters

2-18 About how many centimeters long? Use a centimeter ruler.

_____

2-19 Use a centimeter ruler. Measure. Complete the table.



Subtraction Facts Through 18

2-20 Subtract

$$\begin{array}{r} 18 \\ -\ 9 \\ \hline \end{array}$$

2-21 Solve by writing a number sentence.

Bruce had 17 pennies. He lost 9 pennies. How many did Bruce have left?

2-22

Judy had $14. She bought the doll. How much did she have left?

2-23 Add (+) or subtract (-).

9 + 8 = _____; 17 - 8 = _____

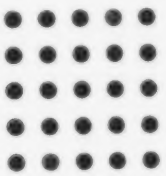
2-24 Solve.
Neil bought a drum for $9 and a bell for $7. How much did he pay?

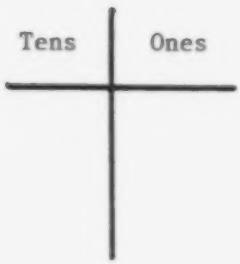
Place Value, Numbers to 100

2-25 Write the number.

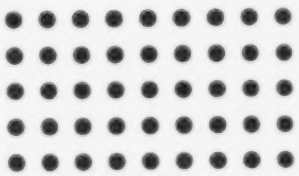
7 groups of ten _____

2-26 How many?





2-27 How many?

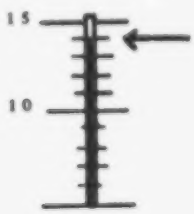


_____

2-28 Which is less?

27 or 77

2-29 What is the temperature?



_____ degrees

2-30 Count. How much money?

____ ____ ____

2-31 Count. How much money?

____ ____ ____ ____ ____

2-32 Count. How much money?

____ ____ ____ ____ ____ ____

2-33 How much money?

____

2-34 How much money?

2-35 Mark the coins you need for change.

Gave	Cost	Change
	42¢	

2-36 What time is shown?

Addition Computation

2-37 Add

$$\begin{array}{r} 30 \\ +\ 50 \\ \hline \end{array}$$

2-38 Add

Write how many ones. Write how many tens if there are any.

Tens	Ones
	6
	5
	2

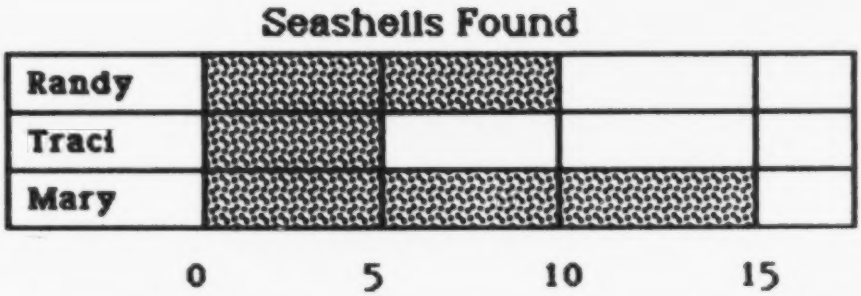
2-39 Add

10¢	1¢
3	4
5	8

2-40 Add

$$\begin{array}{r} 58 \\ +\ 23 \\ \hline \end{array}$$

2-41



How many seashells did Randy and Mary find together?

2-42 Joan bought 7 pencils, 6 markers, and 9 pens. How many pens and pencils did she buy in all?

Subtraction Computation

2-43 Subtract

$$\begin{array}{r} 70 \\ -\ 40 \\ \hline \end{array}$$

2-44 Subtract

Tens	Ones
8	8
- 4	9

2-45 Do you need to rename?

$$\begin{array}{r} 62 \\ -\ 46 \\ \hline \end{array}$$

Yes No

2-46 Subtract

10¢	1¢
8	6
- 5	4

2-47 Add or Subtract

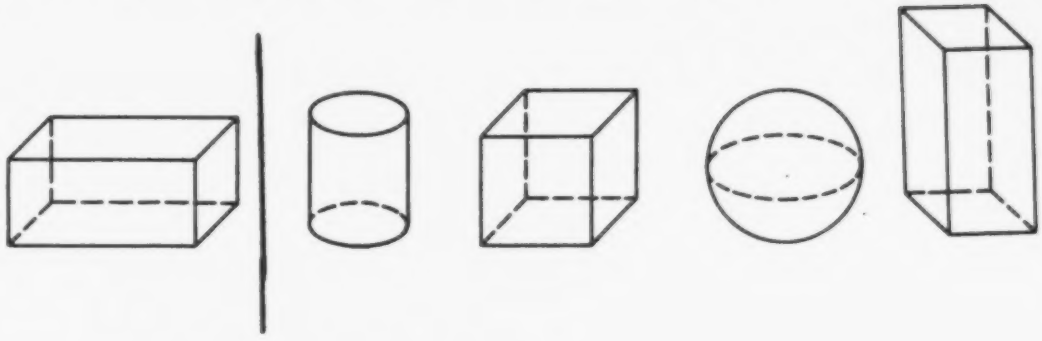
$$\begin{array}{r} 80 \\ -\ 63 \\ \hline \end{array}$$

2-48 Give the answer.

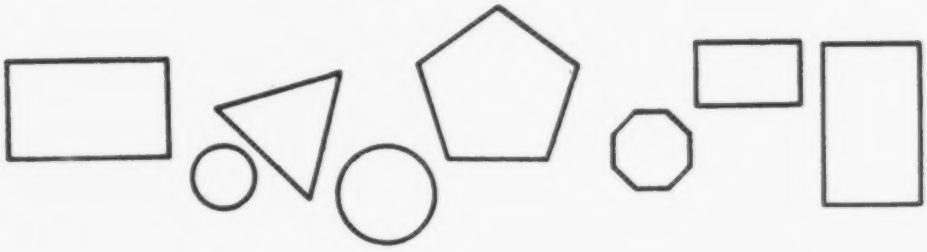
Gary had 92¢. He bought a balloon for 48¢. How much did he have left?

Geometry and Fractions

2-49 Which shape is the same as the first shape?



2-50 How many rectangles?

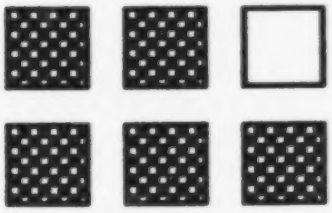


2-51 How many corners?

2-52 What part is white?

$\frac{3}{4}$ $\frac{3}{5}$ $\frac{1}{3}$

2-53 What part is white?



$\frac{1}{5}$ $\frac{1}{6}$ $\frac{5}{6}$

Multiplication Facts Through 27

2-54 Which means the same? Match.

5	6	5	6
x 3	+ 6	5	x 2
		+ 5	

2-55 Write a multiplication fact for these numbers.

3 + 3 + 3 + 3 + 3 + 3

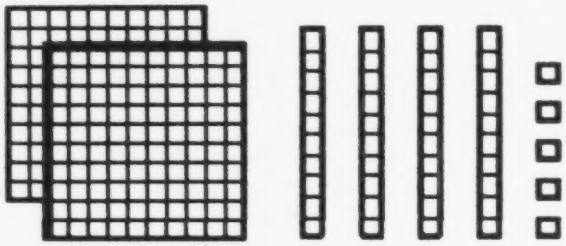
2-56 Do you add (+), subtract (-), or multiply (x)?

Sally is 8 years old. Her sister is 2 years old. How much older is Sally than her sister?

8 + 2
8 - 2
8 x 2

Place Value and Computation: Three-Digit Numbers

2-57 Write the number.



2-58 How much money?

2-59 Which is greater?

672
598

Addition and Subtraction Facts

3-1 Name the position of each number as a number and as a word.

Number	10	8	14	20
Position (number)	10th			
Position (word)	tenth			

3-2 Write two number sentences to compare this pair.
Use > and < .

39 and 32

3-3 Write these numbers in order. Start with the least number.

81 79 82 80

3-4 Add

$$\begin{array}{r} 9 \\ +\ 7 \\ \hline \end{array}$$

3-5 Subtract

$$\begin{array}{r} 15 \\ -\ 6 \\ \hline \end{array}$$

3-6 Solve
Ken bought 7 blue marbles and 5 green marbles. How many marbles did he buy in all?

Numbers and Place Value

3-7 Which is the tens digit in 576?

3-8 Replace the ○ with > or < .

527 ○ 532

3-9 Round 86 to the nearest ten.

Refer to pages I-11 for grade level objectives.

3-10 Write numbers by tens. Begin with 30 and end with 80.

3-11 What is the place value of the 7 in 5,796?

3-12 Beth had only $5. She bought a toy truck for $2. How much does she have left?

$3 $13 $33

Addition

3-13 Add

$$\begin{array}{r} 725 \\ +\ 17 \\ \hline \end{array}$$

3-14

$$\begin{array}{r} 289 \\ +\ 270 \\ \hline \end{array}$$

3-15

$$\begin{array}{r} 342 \\ 53 \\ +\ 61 \\ \hline \end{array}$$

3-16 Solve this problem by estimating the answer.
There are 25 boys and 32 girls swimming in the pool. About how many children are swimming?

3-17 Solve
In a baseball game, Ron's team scored 7 runs. Mary's team scored 6 runs and 8 hits. How many runs were scored in the game?

Subtraction

3-18 Subtract

$$\begin{array}{r} 86 \\ -\ 37 \\ \hline \end{array}$$

3-19 Subtract

$$\begin{array}{r} 534 \\ -\ 273 \\ \hline \end{array}$$

3-20 Solve by estimating the answer.
Glenn needed 77 cups for a picnic. He had 29 cups. About how many more cups did he need to buy?

3-21 Check $\begin{array}{r} 92 \\ -\ 37 \\ \hline \end{array}$ by adding.

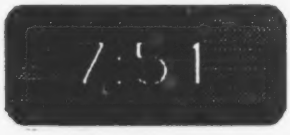
3-22 Write a number sentence. Find the answer.
Mary had 32 pencils. She gave 17 of them away. How many pencils did she have left?

Time and Money

3-23 (1) Write the time shown. (2) What will be the time one minute later?

(1) _____ (2) _____

3-24 Write the time shown to the nearest 5 minutes.



3-25 Write the time shown to the nearest 15 minutes.

3-26 Bill checked a book out of a library on May 3. The book is due in two weeks. What date is it due?

3-27 Which month is the third month of the year?

3-28

Bus Schedule

Bus	Oak Street	Elm Drive	School
One	7:51	8:00	8:11
Two	8:12	8:20	8:29
Three	8:34	8:42	8:51

Sarah rides a bus to school. She gets on the bus at Oak Street. School starts at 8:40. Which is the last bus Sarah could ride to get to school on time?

3-29 Use $ and decimal to write the amount of money.

7 dollars, 3 pennies

3-30 Add

$4.60
+ .34

3-31 Find the amount of change.
Roger bought a game for $2.68. He gave the clerk a $5 bill. How much change did he get?

3-32 Choose the most sensible answer.
Doris has 35 coins. Nineteen coins are pennies. How many coins could be quarters?

7 27 47

Multiplication Facts

3-33 Solve
A tray of watercolors has 2 rows with 7 colors in each row. How many colors are there in all?

3-34 Multiply

9 x 0 = ____

3-35 Look at the ones digit in the answers of the multiplication facts for 5. What is the pattern?

Multiplication

3-36 Multiply

$23 \times 100 = _____$

3-37 Multiply

$$\begin{array}{r} 302 \\ \times\ 3 \\ \hline \end{array}$$

3-38 Multiply

$$\begin{array}{r} 23 \\ \times\ 7 \\ \hline \end{array}$$

3-39 Multiply

$$\begin{array}{r} 73 \\ \times\ 2 \\ \hline \end{array}$$

3-40 Solve by writing a number sentence.
Lila took 2 hours to make one puppet. She made 7 puppets. How many hours did it take to make the puppets?

3-41 Solve
On clean-up day, each of the 23 students in a class collected 4 bundles of newspaper and 9 cans. What was the total number of cans the class members collected?

Measurement

3-42 Measure this sentence to the nearest centimeter.

3-43 Which unit of measure would you use to measure the length of the playground?

centimeter meter kilometer

3-44 Which unit of measure would you use to find out how much 4 dimes weigh?

kilogram gram

3-45 Which unit of measure would you use to find out how much a juice glass holds?

liter milliliter

3-46 Measure the line segment below to the nearest inch.

_____

3-47 Which unit of measure would you use to measure the width of this paper?

inch foot yard mile

3-48 What unit of measure would you use to find out how much three strawberries weigh?

ounce pound

3-49 Choose the unit of measure you would use to find out how much a bathtub would hold.

cup gallon quart pint

Division Facts

3-50 Divide

$14 \div 2 =$ _____

3-51 Solve

Merwin had 27 goldfish. He put 9 goldfish in each jar. How many jars did he use?

3-52 Write the quotient.

$36 \div 9 =$ _____

3-53 Write the quotient.

$7 \div 7 =$ _____

Division

3-54 Write the family of facts for these numbers.

6 54 9

3-55 There are 28 children going to the zoo. If 4 children ride in each car, how many cars will be needed?

3-56 Divide

$8\overline{)39}$

3-57 Divide

$3\overline{)84}$

3-58 Solve
Chad bought a book for $2.85 and a pencil set for $3.59. How much did he spend?

Graphing and Geometry

3-59

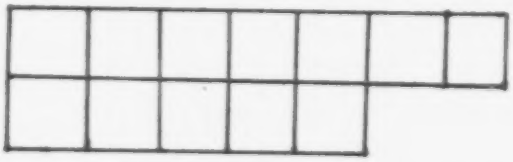
Field goal	● ● ●
Touchdown	● ● ● ● ● ●
Extra Point	●

Each ● means 1 point
The Tigers scored 3 touchdowns in a football game. How many points did they score by touchdowns?

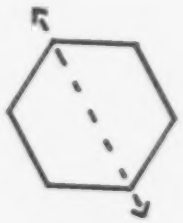
3-60 Use the graph above to solve this problem.
The Lions made a touchdown, an extra point, and a field goal in a game. How many points did they score in all?

3-61 Write yes or no to tell if the figure is congruent with the first figure.

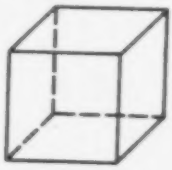
3-62 Write the area of this figure in square centimeters.



3-63 Write yes or no. Is the broken line a line of symmetry?

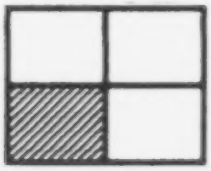


3-64 Give the name of this shape.



Fractions and Decimals

3-65 What fraction names the shaded part?



3-66 What fraction of the bells is shaded?

3-67 Use a $ and decimal to write the value of 3 dimes and a nickel.

GRADE 4

Addition and Subtraction Facts

4-1 Write the numbers in order from least to greatest.

60 35 47 68

4-2 9 + 5 = _____

4-3 17 - 8 = _____

4-4 7 + 1 + 6 + 3 = _____

4-5 Find the answer. There are 9 boys and 7 girls in Mrs. Madley's class. How many more boys than girls are there?

Numbers and Place Value

4-6 Write the number in standard form.

6,000 + 400 + 30 + 9

4-7 Round the number to the nearest hundred.

846

4-8 Solve the problem. Use the table.

Name of County	Population	Land area in square miles
Grand Forks	91,139	3,100
Pembina	5,617	1,200

Find the population of Grand Forks County to the nearest hundred.

4-9 Write the number in standard form.

fifty-one thousand, eight hundred twenty-three

Refer to pages I-15 for grade level objectives.

4-10 Choose the most sensible answer.
How many times does the school band practice each week?

5 50 500

Addition and Subtraction

4-11 Estimate the sum. First round both numbers to the nearest hundred.

238 + 311

4-12
$$\begin{array}{r} 3{,}487 \\ +\ 3{,}666 \\ \hline \end{array}$$

4-13
$$\begin{array}{r} 392 \\ 747 \\ +\ 741 \\ \hline \end{array}$$

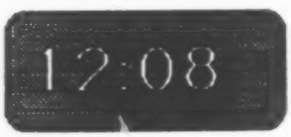
4-14
$$\begin{array}{r} 315 \\ -\ 167 \\ \hline \end{array}$$

4-15
$$\begin{array}{r} \$5.99 \\ +\ 0.17 \\ \hline \end{array}$$

4-16 Write an equation. Then use a calculator to solve.
Four riders rode between Green River and Camp Floyd. The distances they rode were 78, 54, 76, and 77 miles. What was the total distance they traveled?

Measurement

4-17 Write the time shown.



4-18 Use the calendar. Name the day of the week for the date.

March 11

March

Sun.	Mon.	Tues.	Wed.	Thurs.	Fri.	Sat.
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

4-19 To measure the weight of a banana you would normally use:

grams kilograms

4-20 Estimate the length to the nearest centimeter. Then measure it.

_____

Multiplication Facts

4-21 5 x 6 = _____

4-22 Write a problem about buying two different items.

Multiplication

4-23
$$\begin{array}{r} 4{,}834 \\ \times \quad 2 \\ \hline \end{array}$$

4-24 Use a multiplication table. Solve each problem.
What pattern is made by the ones digits in:

a) the products for the factor 5?
b) the products for the factor 4?
c) the products for the factor 8?

4-25
$$\begin{array}{r} 7{,}050 \\ \times \quad 6 \\ \hline \end{array}$$

4-26 $200 \times 60 =$ _____

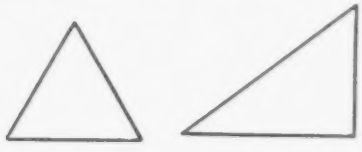
4-27 Estimate the product.
44×68

4-28 Tell whether you add, subtract, or multiply. Then find the answer.
On the Skylab Missions, each astronaut was allowed one shower per week. Only 3 quarts of water were allowed for each shower. How many quarts of water were used for 12 showers?

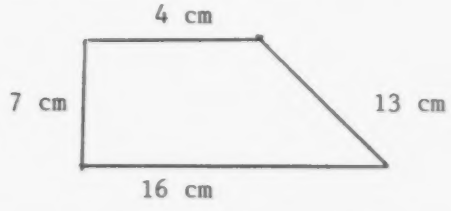
Geometry

4-29 What is this figure?

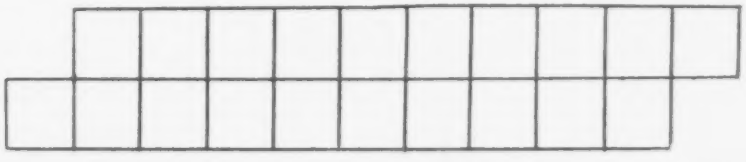
4-30 Tell whether the polygons are congruent.



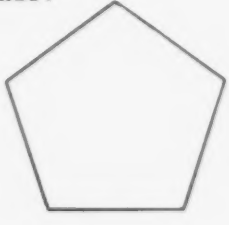
4-31 Find the perimeter of the figure.



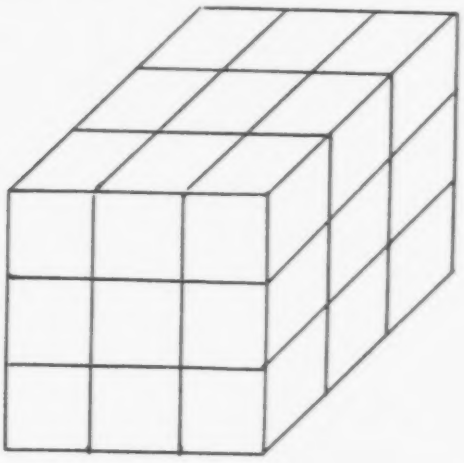
4-32 Find the area of the figure in square centimeters.



4-33 Trace the figure and cut it out. Tell how many lines of symmetry the figure has.



4-34 Find the volume of the figure in cubic centimeters.



Division Facts

4-35 $0 \div 3$

4-36 $81 \div 9$

4-37 Solve the problem.
Sally put 10 jacks on the floor. She picked up 3 jacks on her first try and 3 more on the next. How many jacks were left on the floor?

4-38 $33 \div 4$

4-39 Tell whether you add, subtract, multiply, or divide. Then use a calculator to solve.
William bought 32 drawings. The drawings came in sets of 4. How many sets did William buy?

Division

4-40 $6\overline{)96}$

4-41 Solve the problem.
Dianne has 108 inches of ribbon. If she cuts as many 8-inch pieces as possible, how much ribbon will be left over?

4-42 Find the average of this group of numbers.
36 48 15

4-43 $25\overline{)72}$

Decimals

4-44 Write the decimal.
seventy-five hundredths

4-45 Which decimals have 3 in the tenths place?
73.05 4.8 146.32

4-46 Write the amount with a dollar sign and a decimal point.
sixty-two cents

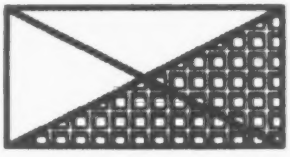
4-47 Use the information below to solve the problem.

Milk	$0.96	Peanut Butter	$1.47
Cocoa	2.65	Fish Sticks	3.97
Cereal	1.89	Celery	0.58

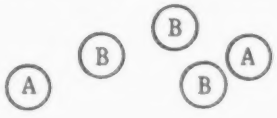
How much more does the peanut butter cost than the celery?

Fractions

4-48 Write a fraction to show how much of the figure is shaded.



4-49 What fraction of the letters are A's?



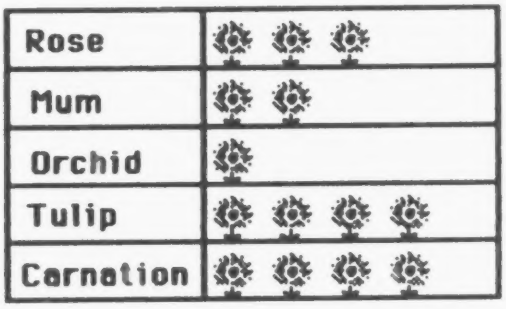
4-50 Add

$$\frac{3}{6} + \frac{2}{6}$$

4-51 Subtract

$$\frac{4}{5} - \frac{2}{5}$$

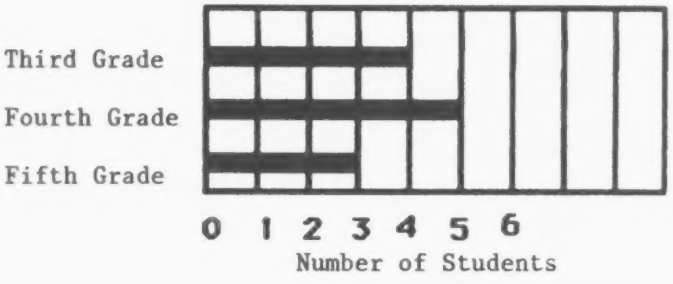
4-52



Students at Hillside School voted for their favorite flower. The pictograph shows the results.

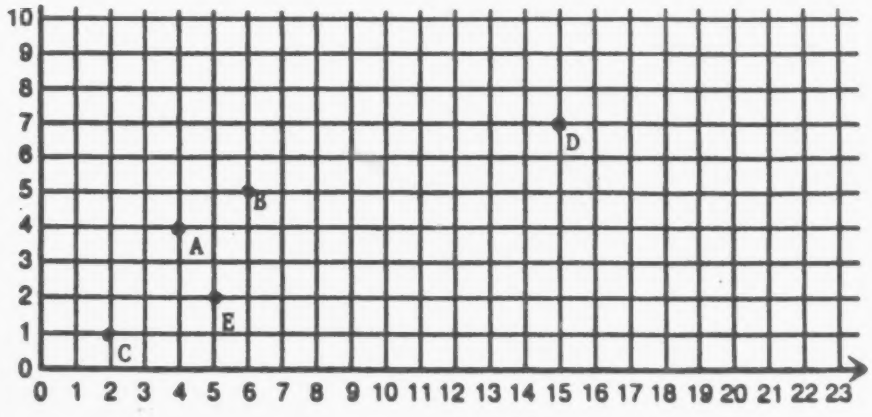
Each means 2 votes.
Use the pictograph above to find the answer.
How many students voted for tulips?

4-53 Students taking computer courses:



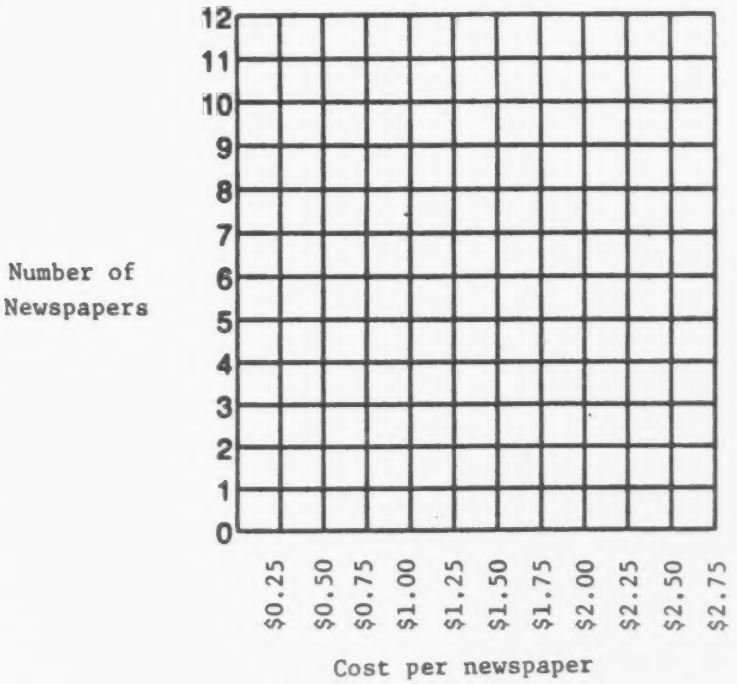
Use the bar graph above to find the answer.
How many third-grade students took the computer course?

4-54



Which letter names the point located by the number pair (5,2)?

4-55



Using the graph above, how much would it cost to buy three newspapers?

Place Value, Addition, and Subtraction

5-1 Tell what the 8 means in 3,891.

5-2 List the numbers in order from smallest to greatest.

1,397 1,497 1,473

5-3 George saw 11 birds. Carol saw more birds than George. How many birds did Carol see?

6 10 14

5-4 Round 4,859 to the nearest hundred.

5-5 Subtract

17 - 8 = _____

5-6 Estimate the sum.

392
+ 507

5-7 Add

6,397
+ 1,809

5-8 Add

3,892
8,071
+ 5,635

5-9 Subtract

18,136
- 3,357

5-10 Subtract

37,002
- 4,075

Refer to pages 1-19 for grade level objectives.

5-11 Write an equation to find the answer.
The Millers drove 285 miles on Thursday. On Friday, the Millers drove 58 more miles than they had driven on Thursday. How many miles did they drive on Friday?

5-12 Subtract

$$\begin{array}{r} \$17.74 \\ -\ 11.07 \\ \hline \end{array}$$

Multiplication

5-13 Give the next five multiples.
4 8 12 16

5-14 Estimate the product.

$$\begin{array}{r} 43 \\ \times\ 47 \\ \hline \end{array}$$

5-15 Multiply

$4 \times 9 \times 9 =$ _____

5-16 Multiply

$$\begin{array}{r} 622 \\ \times\ 34 \\ \hline \end{array}$$

5-17 Multiply

$$\begin{array}{r} \$15.25 \\ \times\ \ \ 6 \\ \hline \end{array}$$

5-18 Find the answer.
The elephant at the zoo weighs 5,178 pounds. The hippopotamus weighs 4,342 pounds. How much more does the elephant weigh than the hippopotamus?

Division With One-Digit Divisors

5-19 Divide

$42 \div 7 =$ _____

5-20 Divide

$9\overline{)65}$

5-21 Divide

$6\overline{)465}$

5-22 Divide

$7{,}703 \div 8$

5-23 Divide

$5\overline{)1{,}652}$

5-24 Write an equation for this problem.
One day, 9 people took a deep-sea fishing trip on the Sea Suzy. They caught a total of 468 pounds of fish. If they shared the fish equally, how many pounds of fish did each person get?

5-25 This is a list of the number of people who went fishing on the Sea Suzy last week.

M	T	W	T	F	S
9	8	11	7	9	10

Find the average number of people on the Sea Suzy each day.

5-26 Divide

$4\overline{)\$37.32}$

Division With Two-Digit Divisors

5-27 Divide

$43\overline{)175}$

5-28 Divide

$86\overline{)608}$

5-29 Divide

$4{,}981 \div 59 =$ _____

5-30 Solve the problem with a calculator.
There are 838 names printed in an office telephone directory. Each page was printed with 35 names. How many pages were needed to print all the names? (Note: Books always have whole pages.)

5-31 Tell which operation to use.
A book company received an order for 5,400 books. If there are 36 books in each box, how many boxes are needed to fill the order?

Addition and Subtraction of Decimals

5-32 Write the decimal.
Twelve and sixty-four hundredths

5-33 Write the price with a dollar sign and decimal point.
A sweatshirt costs nineteen dollars and fifty-four cents.

5-34 Which decimal has 0 in the tenths place?

4.120 6.507 3.043

5-35 Add

$$\begin{array}{r} 91.743 \\ 2.391 \\ +\ 16.567 \\ \hline \end{array}$$

5-36 Subtract

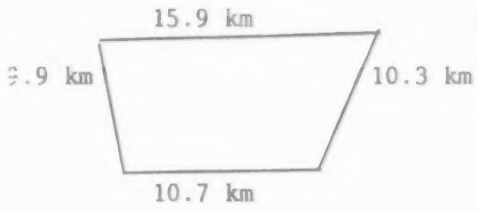
$$\begin{array}{r} 70.01 \\ -\ 14.35 \\ \hline \end{array}$$

5-37 If there is not enough information given, write "too little information." Otherwise, solve the problem.
Ken had $5 to spend on fruit for the camping trip. He bought oranges, bananas, and apples. The fruit cost $3.87. What was the cost of the apples?

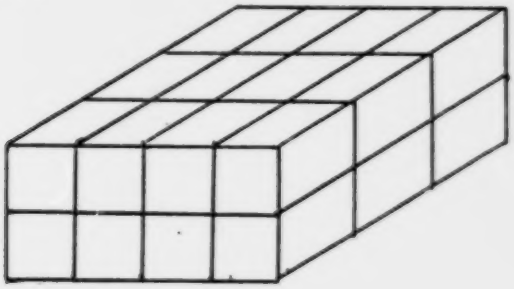
5-38 Solve the problem.
Brian earned $23.60 last month. Of this, $18.75 came from baby-sitting. How much did he earn doing other jobs?

Measurement

5-39 Find the perimeter.



5-40 Find the volume of the container. Each cube represents 1 cubic centimeter.



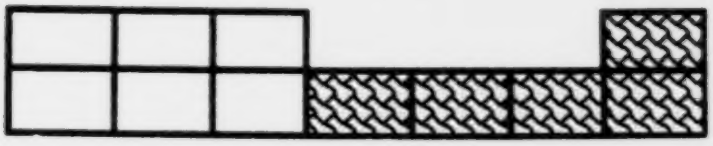
5-41 Would you choose inches or feet to measure the length of a backyard?

5-42 Measure the distance between the cities to the nearest inch. Then estimate the actual distance if one inch is 45 miles.

Bismarck • • Fargo

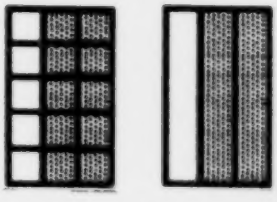
Meaning of Fractions

5-43 Write the fraction to represent the shaded part.



5-44 What fraction of the shapes are circles?

5-45 Write equal fractions for the part that is shaded.

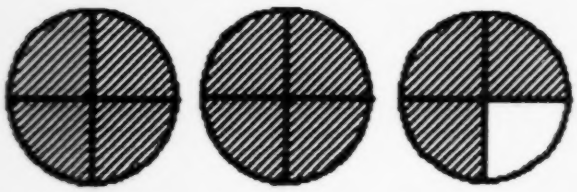


$\frac{\quad}{15} = \frac{\quad}{3}$

5-46 Write the fraction in lowest terms.

$$\frac{21}{28}$$

5-47 Write the mixed number for the picture.



5-48 Write the fractions using the least common denominator.

$$\frac{3}{4} \qquad \frac{1}{5}$$

5-49 Write the improper fraction for $3\ \frac{2}{7}$.

5-50 Roger works $\frac{15}{4}$ hours each day. Write this as a mixed number.

Multiplication of Fractions

5-51 Multiply

$$\frac{1}{3} \times \frac{1}{2} \times \frac{5}{7} = ____$$

5-52 Multiply

$$\frac{3}{8} \times 9 = ____$$

5-53 Use the table to help solve the problem.

Length
1 foot = 12 inches
1 yard = 3 feet
1 mile = 5,280 feet

A jack rabbit can jump as far as 3 1/2 yards. How many feet is this?

Addition and Subtraction of Fractions

5-54 Add

$$\begin{array}{r} 14\ 1/12 \\ +\ 28\ 9/12 \\ \hline \end{array}$$

5-55 Add

$$\begin{array}{r} 6\ 7/8 \\ +\ 9\ 4/8 \\ \hline \end{array}$$

5-56 Add

$$\begin{array}{r} \frac{1}{6} \\ +\ \frac{5}{8} \\ \hline \end{array}$$

5-57 Add

$$\begin{array}{r} 9\ 9/20 \\ +\ 4\ 3/4 \\ \hline \end{array}$$

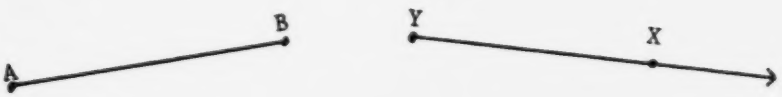
5-58 Subtract

$$\begin{array}{r} 17\ 9/14 \\ -\ 8\ 5/14 \\ \hline \end{array}$$

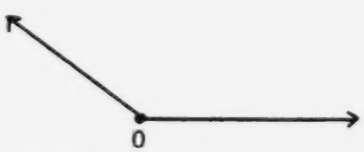
5-59 Solve the problem.
Sam used 3/4 cup flour and 1/3 cup honey in a recipe. How much more flour than honey did he use?

Geometry

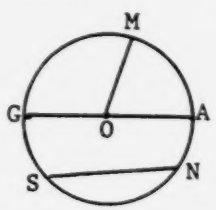
5-60 Circle the ray.



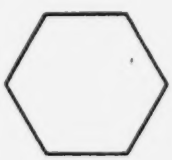
5-61 Use your protractor to measure the angle.



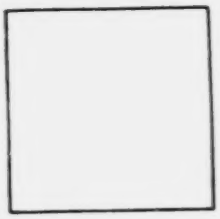
5-62 Name the segment that is a diameter.



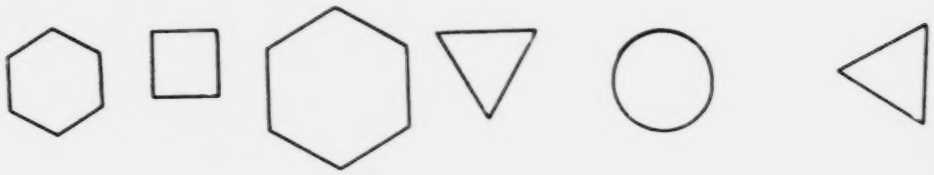
5-63 Give the name of this polygon.



5-64 Draw the lines of symmetry.

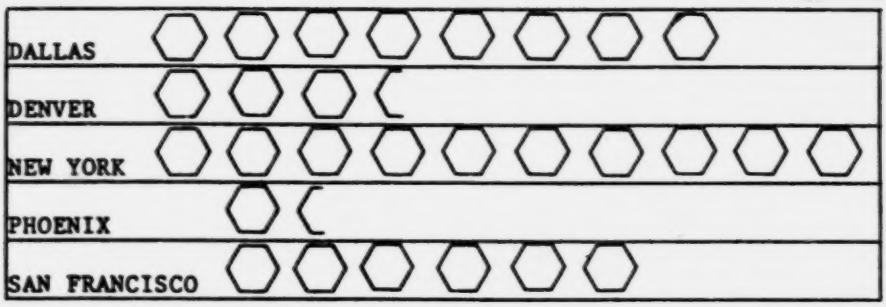


5-65 Circle the congruent figures.



Graphing and Ratio

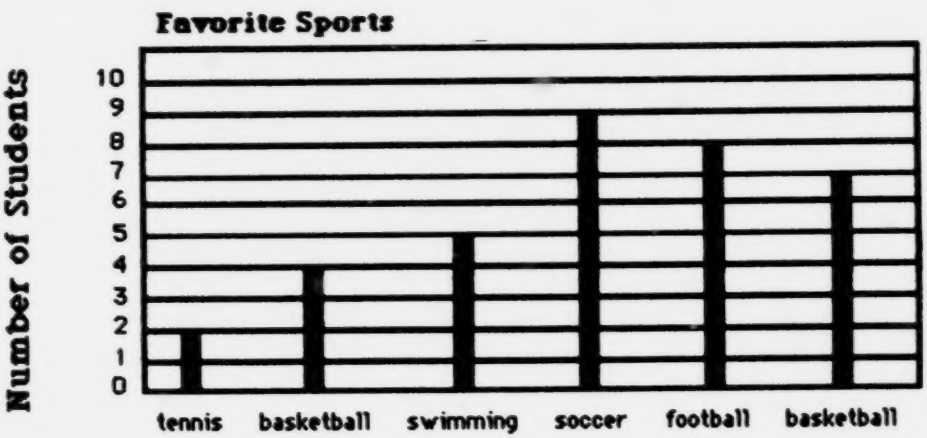
5-66



Each ⬡ means 8 centimeters.

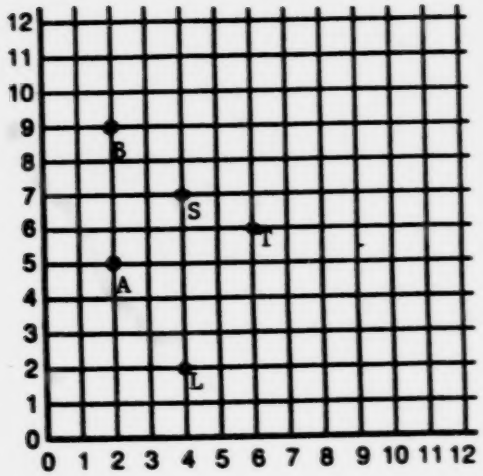
Use the pictograph above to find how many centimeters of rain fell in Dallas.

5-67



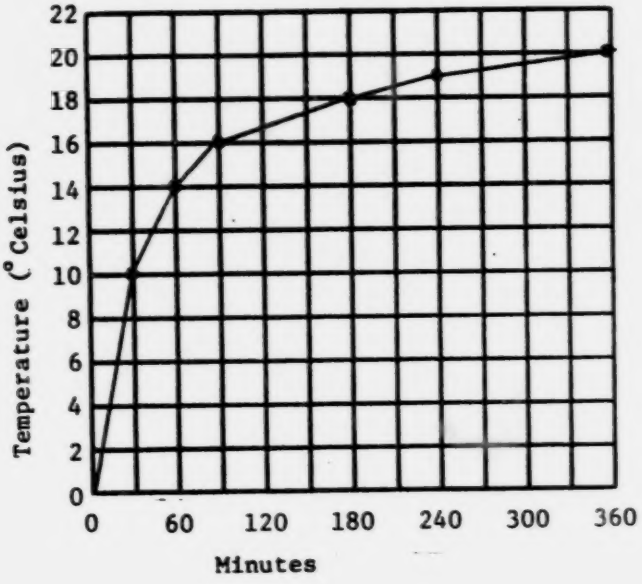
Use the bar graph above to find how many students chose football as their favorite sport.

5-68



Give the ordered pair that gives the location of point S.

5-69



The graph shows the time it takes for the water in an ice cube to melt and warm up to room temperature. How many minutes does it take for the water to warm up from 0°C to 19°C?

GRADE 6

Addition and Subtraction of Whole Numbers

6-1 Write 568 million, 431 thousand, 20 in standard form.

6-2 List these numbers in order from least to greatest.
35,419 35,107 35,940

6-3 Round 6,346 to the nearest thousand.

6-4 Estimate the difference. First round each number to the nearest hundred.
796 - 123

6-5 Add

$$\begin{array}{r} 54,649 \\ 5,195 \\ +\ 3,821 \\ \hline \end{array}$$

6-6 Subtract

$$\begin{array}{r} 25,074 \\ -\ 6,198 \\ \hline \end{array}$$

6-7 Solve the problem.
A truck weighs 24,000 pounds when empty. What does it weigh when carrying 79,000 pounds of cargo?

6-8 Write an equation to find the answer.
45 people watched the movie on Monday. 123 people watched it on Tuesday. How many more people watched the movie on Tuesday than on Monday?

Multiplication of Whole Numbers

6-9 Write two multiplication equations with these numbers.
6 54 9

6-10 Estimate the product.

73 x 45 x 91

Refer to pages I-23 for grade level objectives.

6-11 Multiply

$$\begin{array}{r} 6{,}458 \\ \times\ \ 80 \\ \hline \end{array}$$

6-12 Multiply

$$\begin{array}{r} 7{,}083 \\ \times\ \ 46 \\ \hline \end{array}$$

6-13 Solve the problem.
If almonds sell for $2 a pound, how much will the O'Learys receive for a harvest of 4,689 pounds?

6-14 Find the least common multiple for this pair of numbers.
9 12

6-15 Solve the problem.
There are 4 people in a room. Each person shakes hands with each of the other people in the room. How many handshakes are there in all?

Division of Whole Numbers

6-16 Find the average for this set of numbers.
13 39 41 79

6-17 Solve the problem.
A hockey team has $75 to spend for hockey sticks. How many $4 sticks can they buy?

6-18 Estimate the quotient. First round the dividend and the divisor.

$85\overline{)363}$

6-19 Divide

$65\overline{)26{,}975}$

6-20 Write the operation you would use to solve the problem.
Mrs. Carlson ordered 24 boxes of floppy disks for a total cost of $456. What was the cost of each box?

6-21 Find the answer.
In 1850 about 91,000 people came to California by land or by sea. About 55,000 of them came by land. How many came by sea?

6-22 Find the greatest common factor.
21 and 28

6-23 Tell whether the number is prime or composite.
17

Addition and Subtraction of Decimals

6-24 Write the decimal.
twelve thousandths

6-25 Give the place value for the digit 8.
3.058

6-26 Compare Use >, <, or =.

6.4 ◯ 6.359

6-27 Round to the nearest hundredth.
0.548

6-28 Add

$$\begin{array}{r} 5.634 \\ 78.95 \\ +\ 2.4 \\ \hline \end{array}$$

6-29 Subtract

$$\begin{array}{r} 51.208 \\ -\ 27.7 \\ \hline \end{array}$$

6-30 Use the table to solve the problem.

Number of Erasers \ Number of sketch pads	0	1	2	3	4
0	0	0.90	1.80	2.70	3.60
1	0.50	1.40	2.30	3.20	4.10
2	1.00	1.90	2.80	3.70	4.60
3	1.50	2.40	3.30	4.20	5.10
4	2.00	2.90	3.80	4.70	5.60

Robbie has $3.80. How many sketch pads and erasers can he buy?

6-31 Solve the problem.

After Millie spent $2.84 for a book, she had $1.95 left. How much money did she have before she bought the book?

Multiplication and Division of Decimals

6-32 Multiply

$$\begin{array}{r} 1.48 \\ \times \quad 7 \\ \hline \end{array}$$

6-33 Multiply

$$\begin{array}{r} 0.603 \\ \times\ 0.05 \\ \hline \end{array}$$

6-34 Solve the problem using a calculator.
Lois received a pledge from her mother of $0.15 per mile plus a bonus of $5 for running at least 10 miles. Lois ran 13 miles. How much did her mother pay?

6-35 Divide

$23\overline{)747.5}$

6-36 Divide

$0.81\overline{)5.265}$

6-37 Round the quotient to the nearest tenth.

$3.023\overline{)5.5}$

6-38 Solve the problem.

Find the cost of 100 cans of dog food at $0.44 per can.

Measurement

6-39 Choose the better measure.

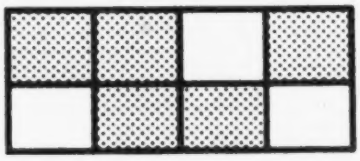
Bowling ball: 7 mg 7 kg

6-40 Choose the most sensible answer for the problem.
Carpeting costs $18.98 per square yard. What was the cost of living room carpeting?

$5.89 $325 $2,657.20

Meaning of Fractions

6-41 What fraction of the squares are shaded?



6-42 Write the fraction in lowest terms.

$\frac{15}{27}$

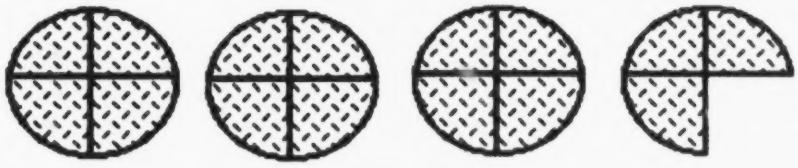
6-43 Write the fractions with the least common denominator.

$\frac{4}{9}$ $\frac{7}{36}$

6-44 List the fractions in order from least to greatest.

$\frac{5}{6}$ $\frac{1}{2}$ $\frac{2}{3}$

6-45 Give a mixed number for the amount.



6-46 Give the mixed number for the fraction.

$\frac{85}{10}$

6-47 Write the fraction as a decimal.

$\frac{427}{1,000}$

Multiplication and Division of Fractions

6-48 Multiply

$2\ 3/4 \times 6 =$ _____

6-49 Multiply using a shortcut.

$\frac{3}{4} \times \frac{8}{15} =$ _____

6-50 If there is not enough information given, write "too little information." Otherwise, solve the problem.
Joey made a $40 down payment on an accordian. An accordian costs about 1/10 as much as a piano. What is the cost of an accordian?

6-51 Divide

$24\ 1/2 \div 1/6 =$ _____

Addition and Subtraction of Fractions

6-52 Add

$\frac{5}{6} + \frac{1}{3} + \frac{4}{9} =$ _____

6-53 Add

$$\begin{array}{r} 16\ 3/8 \\ +\ 5\ 1/4 \\ \hline \end{array}$$

6-54 Subtract

$$\begin{array}{r} 12\ 1/6 \\ -\ 9\ 5/6 \\ \hline \end{array}$$

6-55 Subtract

$\frac{5}{6} - \frac{4}{5} =$ _____

6-56 Subtract

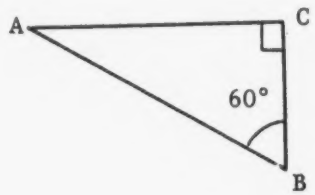
$$\begin{array}{r} 1\ 2/3 \\ -\ 3/4 \\ \hline \end{array}$$

6-57 Solve the problem.
After 3/4 of an hour the bread was not baked. Martin let it bake 1/2 of an hour more. How long did the bread bake?

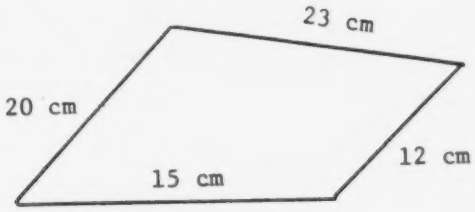
Geometry

6-58 Draw an angle with a measure of 75°.

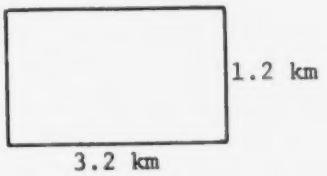
6-59 Find the measure of angle A in the triangle.



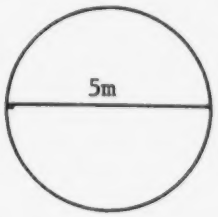
6-60 Find the perimeter of the polygon.



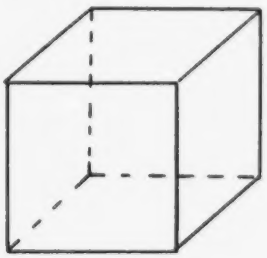
6-61 Find the area of the rectangle.



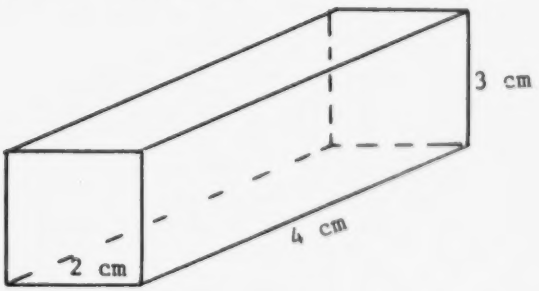
6-62 Find the circumference of the circle whose diameter is 5 m.



6-63 Give the number of edges in the polyhedron.



6-64 Find the volume of the prism.



6-65 Use a formula to solve the problem.
Mopsy the rabbit lives in a hutch that is 4 feet long, 3 feet wide, and 3 feet high. What is the volume of the hutch?

Ratio, Proportion, and Percent

6-66 Complete the list of equal ratios.

Boys / Girls $\quad \frac{96}{80} = \frac{48}{\square} = \frac{\square}{20} = \frac{\square}{10} = \frac{6}{\square}$

6-67 For the proportion, show that the cross-products are equal.

$$\frac{10}{12} = \frac{15}{18}$$

6-68 Use cross-products to find n.

$$\frac{27}{24} = \frac{36}{n}$$

6-69 Solve the problem.
20 schillings were worth $2.40. What were 100 schillings worth?

6-70 Write the decimal as a percent.
0.6

6-71 Write the percent as a fraction.
25%

6-72 Find the number.
5% of 180 = _____

6-73 Find the number using a fraction.
50% of 176 = _____

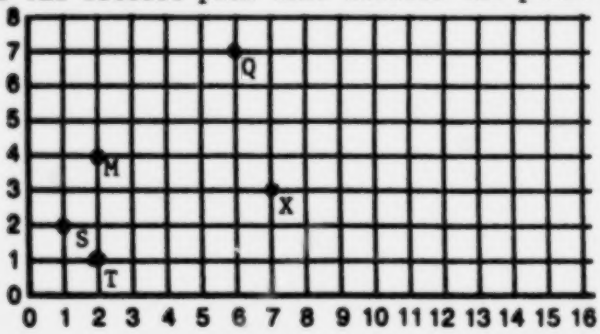
6-74 Solve the problem using a calculator.
Jamie has $25. Can she buy a jogging suit that costs $23.50 plus 5% sales tax?

6-75 Write an equation to solve the problem.
Lee made 40% of his 30 field-goal attempts. How many field goals did he make?

Graphing

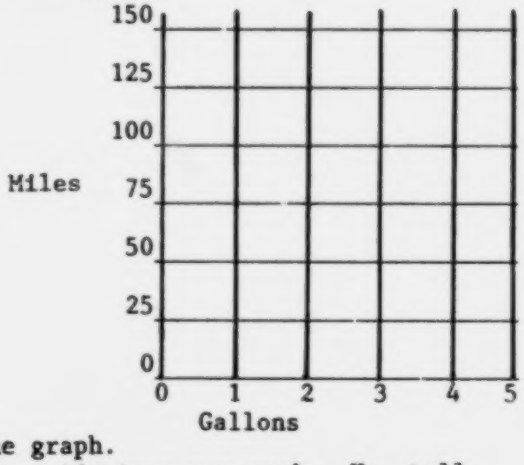
6-76 A total of 650 students attended the Lane School Book Fair. The circle graph shows which kinds of books they bought. How many students bought adventure books?

6-77 Give the ordered pair that locates the point M.

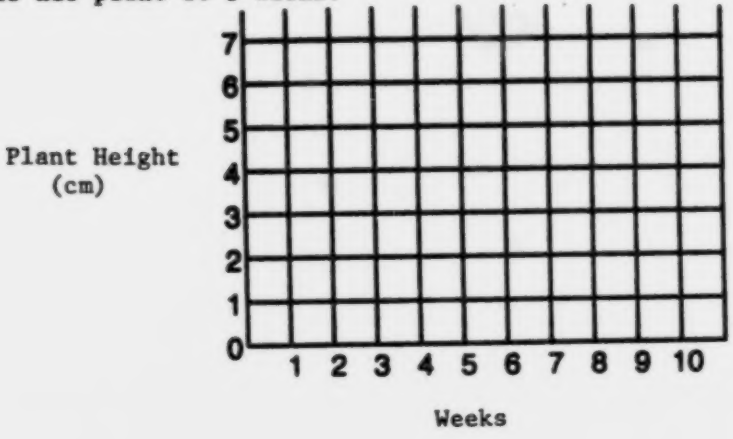


6-78 Use the table below to draw a line graph.

Number of Gallons	Number of Miles
1	25
2	50
3	75
4	100
5	125



6-79 Solve the problem by using the graph.
Mr. Moe's plant grows about 2 centimeters per week. How tall is his plant at 3 weeks?



Addition and Subtraction of Whole Numbers

7-1 Tell what the 7 means in the number.
423,759

7-2 List the numbers in order from least to greatest.
1159 993 1151 1068

7-3 Round to the nearest thousand.
8572

7-4 Estimate the difference.
75,002 - 55,347

7-5 Add

$$\begin{array}{r} 8{,}346 \\ +\ 4{,}479 \\ \hline \end{array}$$

7-6 Subtract

$$\begin{array}{r} 6{,}081 \\ -\ \ 947 \\ \hline \end{array}$$

7-7 Find the answer.
Total sales for October were $31,809. Compared to September sales, this was a decrease of $8,687. Find September sales.

7-8 If there is not enough information given, write "too little information." Otherwise, solve the problem.
Each person in Ann's family wants a sandwich. They cost $1.25 each. How much will Ann pay for all the sandwiches?

Multiplication and Division of Whole Numbers

7-9 Estimate the product.
408 x 963

7-10 Multiply

$$\begin{array}{r} 1{,}823 \\ \times\ \ 34 \\ \hline \end{array}$$

7-11 Divide
18,217 ÷ 62 = _____

Refer to pages I-29 for grade level objectives.

7-12 Divide

$60{,}904 \div 331 = ____$

7-13 Find the answer using a calculator.
The printer will charge $1,950 to print 650 books. Find the cost to print one book.

7-14 Solve using a calculator.
Gym shorts cost $8 each and shirts are $5 each. How much will 15 shirts and 15 shorts cost in all?

7-15 Compute

$5 \times 4 + 6 \div 2 = ____$

7-16 Compute

$(639) \times (54) + (0) \times (72)$

7-17 Solve

8 times a number n is 96. Find n.

Number Theory

7-18 Tell if the number is divisible by 2, 3, 5, 9, or 10.
17,040

7-19 Write in standard form.

$8^2 \times 3^2$

7-20 Tell whether the number is prime or composite.
295

7-21 Make a factor tree and write the number as a product of its primes using exponents.
1155

7-22 Find the G. C. F.
56 84 49

7-23 Find the L. C. M.
30 18

Decimals

7-24 Write as a decimal.

$$\frac{7007}{1{,}000{,}000}$$

7-25 Use $>$, $<$, or $=$ to compare.

$7.04 \bigcirc 7.041$

7-26 Round to nearest thousandth.

4.80036

7-27 Solve

$$\begin{array}{r} 5.2 \\ -\ 0.027 \\ \hline \end{array}$$

7-28 Solve

$0.51 \times 0.015 =$ _____

7-29 Estimate the product.

83.5×5.7

7-30 Divide

$0.2601 \div 9 =$ _____

7-31 Solve for n.

$34.02 = n + 9.881$

7-32 Solve for b.

$$b = \frac{9.126}{7.02}$$

Multiplication and Division of Fractions

7-33 Write in fraction form.

$3 \div 8$

7-34 Write in lowest terms.

$$\frac{24}{60}$$

7-35 List in order from least to greatest.

$$\frac{2}{5} \quad \frac{1}{3} \quad \frac{3}{10}$$

7-36 Compare Use $>$, $<$, $=$.

$$8\frac{7}{16} \bigcirc 8\frac{3}{8}$$

7-37 Write as an improper fraction.

$$7\ \frac{8}{9}$$

7-38 Write as a fraction in lowest terms.

0.325

7-39 Multiply

$$\frac{5}{8} \times \frac{3}{4} \times \frac{2}{5}$$

7-40 Multiply

$$(2\ \frac{2}{3})(2\ \frac{1}{2})$$

7-41 Divide

$$\frac{15}{16} \div \frac{5}{8}$$

7-42 Divide

$$5\ \frac{1}{3} \div 2\ \frac{2}{3}$$

7-43 Solve the equation. Solve for n.

$$(1\ \frac{1}{3})n = \frac{2}{3}$$

7-44 Estimate
If 50 nickels weigh about 1/2 pound, how many nickels are there in 12 pounds?

Addition and Subtraction of Fractions

7-45 Add

$$7\ \frac{1}{8} + 6\ \frac{5}{6} = ____$$

7-46 Subtract

$$14\ \frac{7}{10} - 8\ \frac{5}{6} = ____$$

7-47 Solve
The chorus practiced 3 1/2 hours a week for 7 weeks. How many hours in all did they practice?

7-48 Write an equation.
Sally jogged 21 miles in 2 weeks. How far did she jog in one day, if she jogged an equal distance each day?

Ratio, Proportion, and Percent

7-49 Are these ratios equal?

$$\frac{1.8}{2.4} \qquad \frac{3}{4}$$

7-50 Solve

$$\frac{12}{18} = \frac{m}{15}$$

7-51 Write a proportion and solve.
Using the scale 2 cm = 5 km, find the distance in km between the football field and the river if it measures 10 cm on the map.

7-52 Write as a decimal.
0.17%

7-53 Write as a percent.
$\frac{1}{6}$

7-54 Solve
What is 45% of 9.2?

7-55 Solve using a calculator.
Portia earns $500 a month plus a commission of 14% of her total monthly sales. What was her salary for the month if the sales totaled $14,650?

7-56 Solve
70 is what percent of 84?

7-57 Write an equation.
The Pirates won 16 games. If they played 20 games, what percent of the games did they win?

Measurement

7-58 Choose the best measure.
Mass of a fishing worm.
8 mg 0.8 g 80 g

7-59 Choose the best answer.
Weight of a bar of soap.
4 oz. 4 lb. 4 tons

7-60 Compute
3 kg - 785 g = ____

EMC: 1/86

7-61 Solve
19 hr. 20 min. - 9 hr. 50 min. = ____

7-62 Solve
If it takes 2½ yards of net for a dancer's costume, will 8 yards be enough for 3 costumes?

Geometry

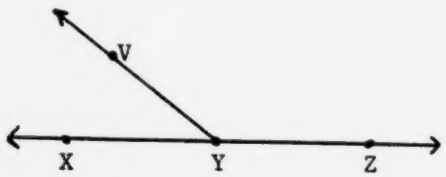
7-63 Draw three rays, each having J as its endpoint.

7-64 Draw an angle of 93°. Tell whether it is acute, right, or obtuse.

7-65 Draw and label.

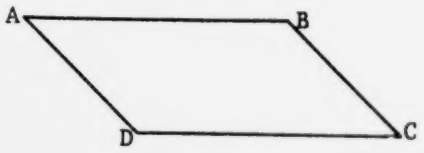
$\overrightarrow{MN} \perp \overrightarrow{LM}$

7-66 In the figure, is $\angle$ VYZ congruent to $\angle$ VYX?

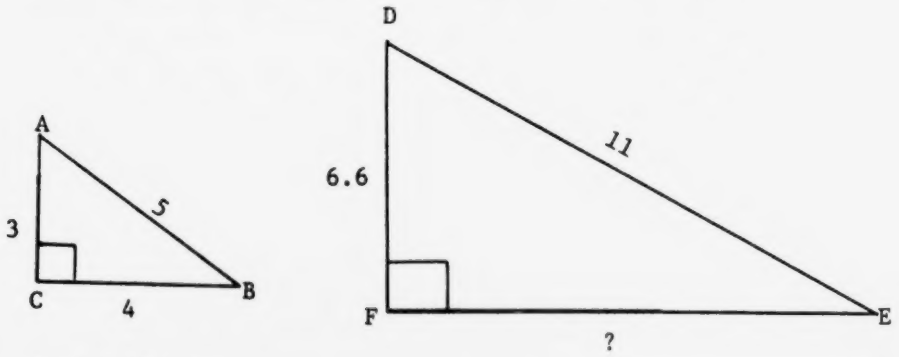


7-67 Give the measure of angle C.

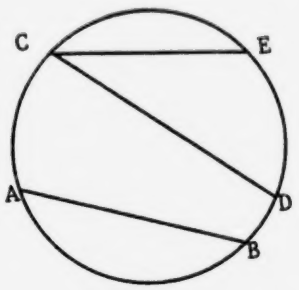
7-68 Name this polygon.



7-69 Find the missing length. (Triangles are similar.)



7-70 Name a chord.

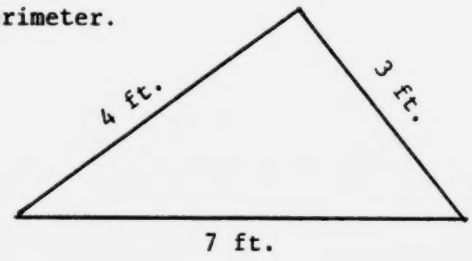


7-71 Count the number of faces, vertices, and edges on your book and tell what kind of a polyhedron you have.

7-72 How many chords can be drawn if 5 points are marked on a circle?

<u>Perimeter, Area, and Volume</u>

7-73 Find the perimeter.



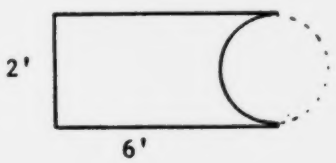
7-74 Find the circumference of a circle whose radius is 3.6 cm (use 3.14 for π).

7-75 Find the area of a rectangle 3 1/2 ft. by 4 2/3 ft.

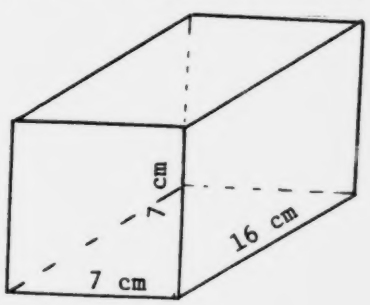
7-76 Find the area of a triangle with a base of 3.5 cm and a height of 4.2 cm.

7-77 Find the area of a circle. Use 3.14 for π .
Radius 5.5 yards.

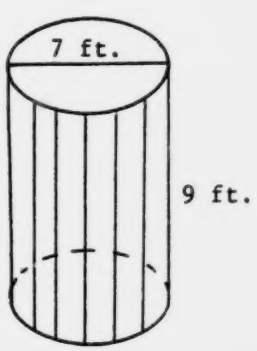
7-78 Find the area of the enclosed region.



7-79 Find the surface area of the figure by adding the areas of its faces.



7-80 Find the surface area.



7-81 Find the volume of a rectangular prism which is 7 feet long, 5 feet wide, and 4 feet deep.

7-82 Find the volume of a cylinder whose radius is 4 m and height is 9.5 m.

7-83 The volume of a bin is 28,800 cubic feet. It is 60 feet long and 40 feet wide. What is the height of this bin? (Use a calculator.)

Statistics and Probability

7-84 Construct a frequency table and find the range of the speeds for these cars.
42, 49, 50, 55, 55, 36, 41, 48, 54, 51, 53, 44, 35, 50, 52

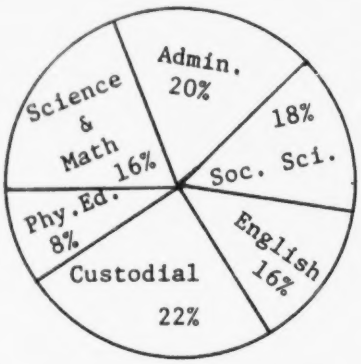
7-85 Construct a double bar graph to show the results of the Student Council election.

	Grade 7	Grade 8
Murphy	115	230
Addison	340	290
Jenson	270	250

7-86 Construct a broken-line graph for the monthly sales for the past year.

January	$35,000	July	$58,000
February	$28,000	August	$54,500
March	$41,000	September	$51,000
April	$42,500	October	$43,000
May	$46,000	November	$39,000
June	$52,500	December	$31,000

7-87 What percent of the employees are in nonteaching positions?



7-88 Find the median for this set of grades.
37, 42, 48, 50, 50, 35, 41, 49

7-89 Using the circle graph for 7-87, find the number of teachers in Social Studies and English if the total number of employees for the graph is 750.

7-90 Dance Club Birth Months

MONTHS	TALLY
Jan.-Mar.	𝍸 𝍸 𝍸
Apr.-June	𝍸 𝍸 𝍸 ||||
July-Sept.	𝍸 𝍸 𝍸 |||
Oct.-Dec.	𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 ||

The 84 members of the dance club are grouped according to month of birth. Estimate the probability that a member will be born in June.

7-91 If in the year 1980 the probability that a person would be injured in some sort of an accident was 9/200 how many people would you expect to be injured in a group of 81,000 persons? (Use a calculator.)

Integers and Coordinate Graphing

7-92 Write the opposite of -143.

7-93 List in order from greatest to least.
3 -6 -9 10

7-94 Add
(-13) + (-4) + (-7) = ____

7-95 Add

$(-4) + (-9) + 5 =$ _____

7-96 Subtract

$(-12) - (-12) =$ _____

7-97 Multiply

$(-23)(-5) =$ _____

7-98 Divide

$-51 \div 17 =$ _____

7-99 Compute

$11 + (-4)(1 - 3) =$ _____

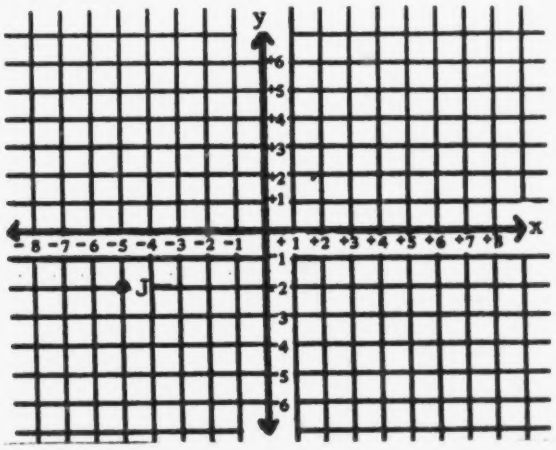
7-100 Solve

$\frac{(-4) - 10}{2} - 7 =$ _____

7-101 Plot the following points on a grid.

A (-2,0)
B (-6,4)
C (-1,-5)
D (-4,-6)
E (3,-8)
F (7,-4)
G (1,7)

7-102 Give the coordinates of point J on this graph.



7-103 Make a table and graph the equation $y = x + 1$.

GRADE 8

Whole Numbers and Number Theory

8-1 Write in expanded form.
9,502,050

8-2 Estimate the answer.
36,215 - 23,105

8-3 Add
4,501 + 14 + 1,764 + 603 + 10,000 = _____

8-4 Multiply
696 x 72 = _____

8-5 Divide
13,763 ÷ 623 = _____

8-6 Solve
Geese can fly 12 hours a day at a speed of 65 m.p.h. At this rate, how far can they fly in 2 days?

8-7 Write the prime factorization of 162 using exponents.

8-8 Find the GCF of 32 and 64.

8-9 Find the LCM of 35 and 14.

Equations and Graphs

8-10 Solve
$63 + a = 216$

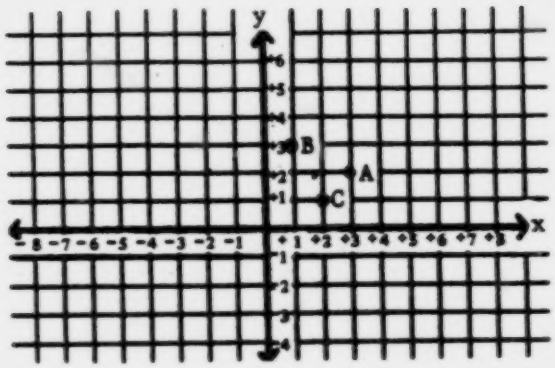
8-11 Solve
$\frac{x}{6} = 66$

8-12 The water in the fish tanks was changed every 16 days during the 224 days of an experiment. How many times was it changed?

8-13 Solve
$14 - \frac{7t}{2} =$ _____

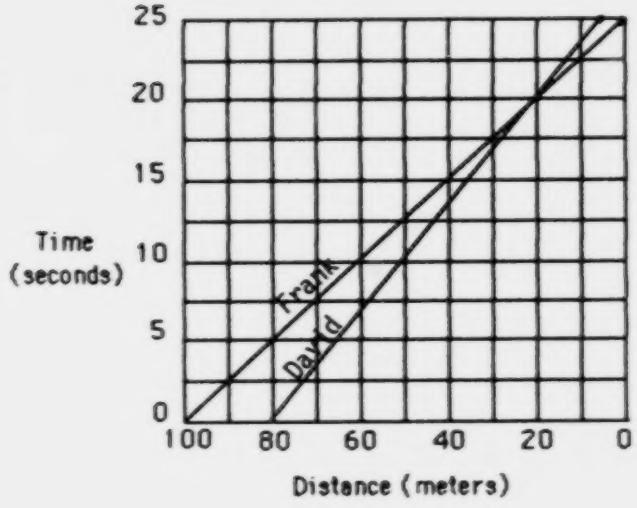
Refer to pages I-35 for grade level objectives.

8-14



Locate Point A by using ordered pairs of numbers.

8-15



Frank is 100 meters from the building. David is only 80 meters from the building. If Frank runs 4 meters per second and David runs 3 meters per second, how long will it take Frank to catch up with David?

Decimals

8-16 Tell what the 8 means in:
4.00816

8-17 Write in order from least to greatest.
0.247 0.24 0.2704

8-18 Round to tne nearest tenth.
0.1578

8-19 Solve
0.8 - 0.7312 = _____

8-20 If not enough information is given write "too little information." Otherwise solve the problem.
A 6 kilogram bag of apples costs $3.98. What is the price per apple?

8-21 Multiply

$(0.015)^2 =$ _____

8-22 Divide

$4.62 \div 0.009 =$ _____

8-23 Solve

$10.71 = \frac{x}{5.1}$

Fractions

8-24 Write in the lowest terms.

$\frac{90}{210}$

8-25 List from smallest to largest.

$\frac{2}{3} \quad \frac{4}{5} \quad \frac{7}{10}$

8-26 Write as a decimal.

$\frac{7}{32}$

8-27 Multiply

$\frac{1}{5} \times \frac{3}{8} \times 4 =$ _____

8-28 Divide

$4\ 1/4 \div 7\ 7/8 =$ _____

8-29 Subtract

$23\ 3/10 - 4\ 5/12 =$ _____

8-30 Solve

$r - 8\ 3/5 = 12\ 2/3$

8-31 Solve

$\frac{n}{7} - \frac{1}{10} = \frac{1}{30}$

Ratio, Proportion, and Percent

8-32 Do these ratios form a proportion? Write yes or no.

$\frac{0.3}{0.5} \quad \frac{4}{6.4}$

8-33 Use cross-products and solve.

$\frac{16}{21} = \frac{a}{84}$

8-34 Use a proportion to solve.
Lenora can sew 5 aprons in 7 hours. How long will it take her to make 105 aprons?

8-35 Write as a decimal.
4.3%

8-36 Write as a percent.
$\frac{11}{16}$

8-37 Write as a fraction and a decimal.
0.25%

8-38 Solve
9 1/2% of 28 is what number?

8-39 Solve
Joe put $1,000 in a one-year saving certificate that will give 9% interest at the end of the year. He must pay 25% tax on that interest income. What is the total amount he will have left? (Use a calculator.)

8-40 Solve
What percent of 4.8 is 3.2?

8-41 Solve
A boat trailer costs $499.50, plus sales tax. If the tax is 7%, what is the amount of the tax?

8-42 Solve
9 is 166 2/3% of what number?

8-43 Solve
Maureen is paid a 25% commission on all sales over $700. What is her commission on sales of $2,950? (Use a calculator.)

Measurement

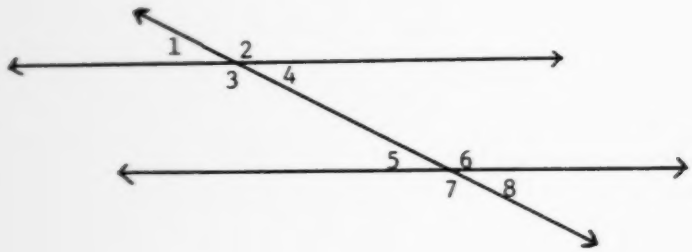
8-44 Choose the best measure for the weight of a pint paint can when it is empty.
3 oz. 3 lb. 3 tons

8-45 Which measure is best for measuring the width of a person's finger?
cm or mm

Geometry

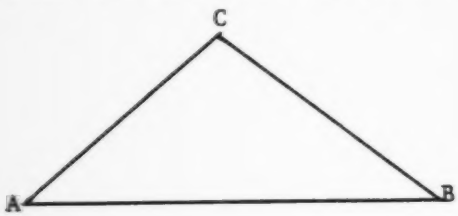
8-46 Give the measure of the complement of a 49° angle.

8-47

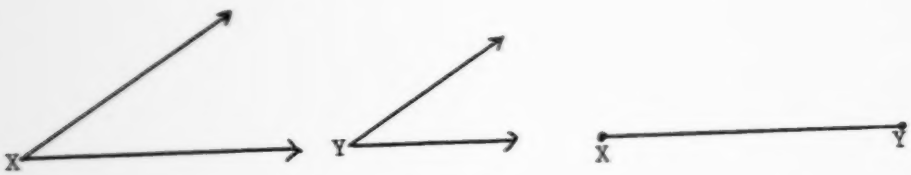


Name one pair of alternating interior angles.

8-48 Trace triangle ABC and construct a perpendicular bisector to side AB.



8-49 Trace the segments and angles given below and construct a triangle using these parts.

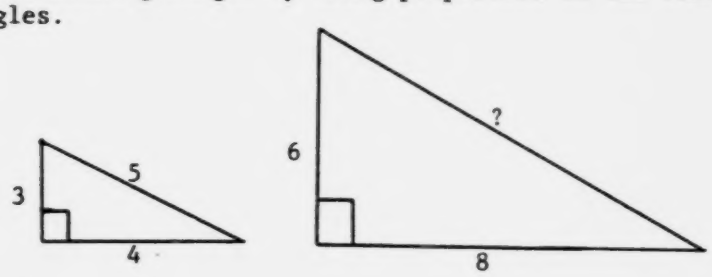


8-50 If the measures of the angles of a triangle are 90°, 45°, and 45°, what kind of a triangle is it?

8-51 Sketch a quadrilateral with exactly 2 right angles.

8-52 If the corresponding sides of two triangles are congruent, are the triangles congruent?

8-53 Find the missing length by using proportion in the similar triangles.



8-54 Draw a hexagonal prism.

8-55

a) triangular pyramid

b) rectangular pyramid

Using figures a and b, tell the number of edges in an octagonal pyramid.

Perimeter, Area, and Volume

8-56 Find the perimeter of a parallelogram whose sides are 7.8 cm and 12.4 cm.

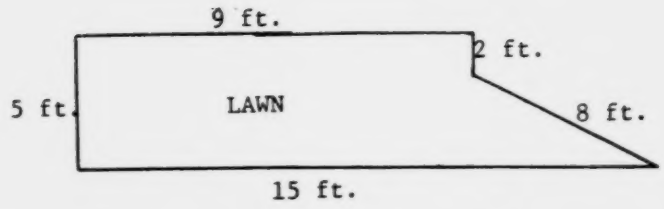
8-57 Find the area of a triangle whose base is 26 inches and height is 9 inches.

8-58 Find the area of a trapezoid with bases of 6.2 m and 4.4 m and a height of 3.0 m.

8-59 Find the circumference of a circle with a radius of 4.4 m. Use 3.14 for π.

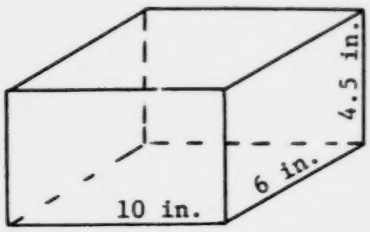
8-60 Find the area of a circle with a diameter of 9.6 miles. Use 3.14 for π.

8-61



How many square feet of sod must be purchased to cover this lawn?

8-62



Find the surface area of this polyhedron.

8-63 Find the total surface area of a cylinder 50 cm high with a radius of 20 cm. Use 3.14 for π.

8-64 Estimate the amount of screening needed to make a large gerbil cage. The cage floor, which is of heavy plastic, is 3.5 feet by 4.25 feet. The height of the cage will be 2 feet.

8-65 Find the volume of a soup can that has a diameter of 7 cm and a height of 10 cm. Use 3.14 for π.

8-66 Find the volume of a cardboard cone with radius of 4.2 in. and height of 14.2 in. Use 3.14 for π.

Statistics and Probability

8-67 The following is a list of the number of students in Mr. Lyng's class who read the following books:

Treasure Island, 4; Sounder, 9; 20,000 Leagues Under the Sea, 8; Time Machine, 4.

What is the range of the data for these books?

8-68 Make a circle graph for the following data. Round to the nearest degree.

Newspapers	$120
Magazines	$ 50
Paperback books	$ 35
Hardcover books	$ 45

8-69 Find the mean for this set of grades:
92, 62, 81, 85, 75, 100, 92, 89, 89, 52, 89, 74.

8-70 Using the following data, make a broken-line graph to indicate an increase in circulation.

1984	250,000
1985	250,100
1986	250,200
1987	250,500

8-71 There are 12 students in the art class. Each has a birthday in a different month of the year. Bill has a birthday in July. What is the probability that someone else, selected at random, has a birthday in the same season?

8-72 Leona chose two of the digits 0 through 9 at random. If the digits could be repeated, what is the probability that both digits were even?

8-73 Sally wrote each of the digits 0 through 9 on a card, put the cards in a hat and mixed them up. If she draws out three cards, and does not replace them, what is the probability that all three digits are greater than 6?

8-74 A survey of 100 randomly selected students at State University were asked where they were from. The results are shown in the table. If there are 5,000 students in all at the school, how many would be expected to be from North Dakota?

STUDENTS' HOMES	
Illinois	38
North Dakota	26
Indiana	22
Minnesota	10
Other	4

8-75 In the above problem, if there are 2,010 freshman, estimate the number from North Dakota.

Integers

8-76 Write the opposite of a deposit of $4,058.

8-77 List in order from smallest to largest.

-18 4 -6 9

8-78 Add

$(-4) + 22 + (-32) + 4 =$ _____

8-79 Subtract

$(-17) - (-17) - 3 =$ _____

8-80 Multiply

$(-2)(-6)(8)(-2) =$ _____

8-81 Divide

$\frac{-702}{27} =$ _____

8-82 Evaluate the expression for S = 10 and t = -6.

$$\frac{2S - 5t}{S - 12}$$

8-83

SAVINGS ACCOUNT BALANCE

	January	February	March
Anne	$125	$153	$ 75
Brad	$ 16	$ 30	$ 42
Carol	$201	$262	$334
Steve	$118	$135	$193

Using the Savings Account Balance chart, find the average change in the account balances between February and March. (Use a calculator.)

Rational Numbers and Irrational Numbers

8-84 List in order from smallest to largest.

0.6 -0.6 -1 6

8-85 Subtract

$(-1.3) - 9.6 =$ _____

8-86 Divide

$(-3/7) \div (5\ 1/7) =$ _____

8-87 Write in standard form. 10^{-4}

8-88 Write in scientific notation. 836,000

8-89 Multiply, using scientific notation, giving the answer in standard form.

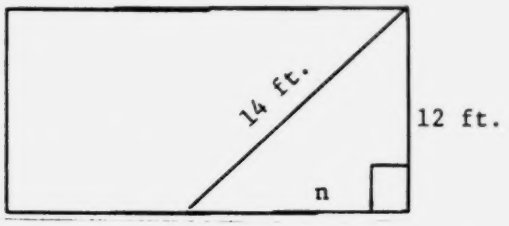
$(1.6 \times 10^{-2}) \times (4.8 \times 10^{-5})$

8-90 Between which two consecutive integers is $\sqrt{97}$?

8-91 Is $\sqrt{81}$ a rational or irrational number?

8-92 Using the Pythagorean Theorem, find the hypotenuse of a right triangle whose side lengths measure: a = 24 and b = 25.

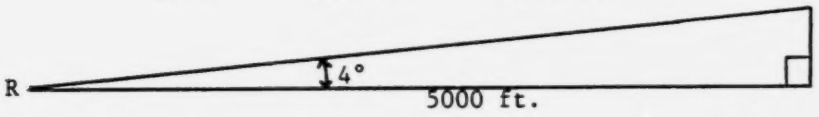
8-93



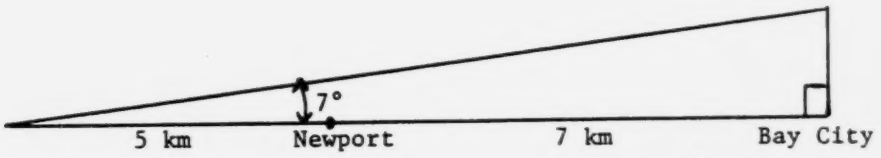
Lenora is making a gameboard with tape on the laundry room floor. She needs to know the length of n.

8-94 Select the correct answer. On one of the steeper parts of Highway 40, the measure of angle R = 4° (see diagram). In a horizontal distance of 5000 feet, how many feet does the road rise?

35 ft. 350 ft. 3500 ft.



8-95



An airplane is approaching the airport. What was the altitude, approximately, of the plane when it passed over Bay City?

.15 km 1.5 km 15 km

Equations, Inequalities, and Graphing

8-96 Solve

$$-6.4 = n + 3.7$$

8-97 Solve

$$4x - 9 = -1$$

8-98 Graph on a number line.

$$y > -4$$

8-99 Make a graph to solve.

Reliable Bike charges $2 plus $.50 an hour. Quality Bike charges $1 plus $.75 an hour. When will the cost be the same?

MATHEMATICS ACTIVITIES K-8

MATHEMATICS ACTIVITIES

Mathematics instruction can be more effective by the proper use of mathematical activities. Learning mathematics can be enhanced by active and concrete experiences. Activities also help the students relate mathematical ideas to the real world and to real objects.

The following pages contain a cross section of mathematical activities:

III-3 to III-7 Primary
III-9 to III-19 Intermediate
III-21 to III-31 Junior High

Activities - Primary

NUMBERS AND NUMERATION

Number/Picture Cards

(For the class: sandpaper, number/picture cards, clothespins.)

Make picture cards with numbers cut from sandpaper, so that students "see" the number, the word name, and the group of objects, and they can "feel" how to form the numbers. Include arrows to direct the students in writing the number.

Using a "sandpaper number/picture card," have the students practice forming the number, and attaching the correct number of clothespins.

PLACE VALUE

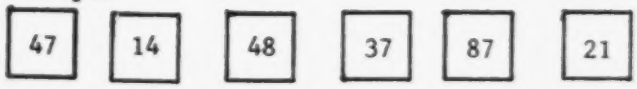
Bank On It

Number of Players: 2-4

Materials: 48 cards, each with a two-digit number

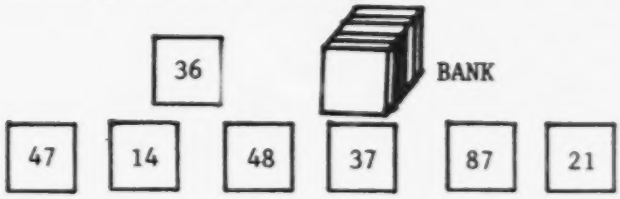
Rules:

1. Mix the cards and deal six cards to each player. Players place their cards face up, from left to right, in the order they receive them. Example:



2. The remaining cards are placed face down. These cards are the bank. Turn the top card over and place it next to the bank, forming a discard pile.

3. The object of the game is to get six cards in order from least to greatest, from left to right.



4. In turn, each player chooses one new card. If a player cannot use the card on top of the discard pile, he/she may choose the top card from the bank. The new card may be used to replace one of the player's cards. In the sample above, the player could take the card with 36, put it in place of the 48, and discard the 48. If the player cannot use the new card, he/she may discard it. On each turn, the player must take and discard one card.

5. If the bank is used up before any player has won, make a new deck from the discard pile.

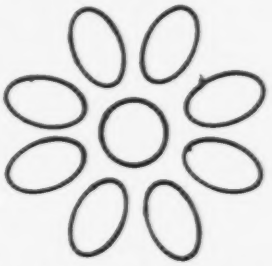
6. The winner is the first player to get six cards in order from smallest to largest, from left to right.

Variation: Change the object so players must get six cards in order from largest to smallest.

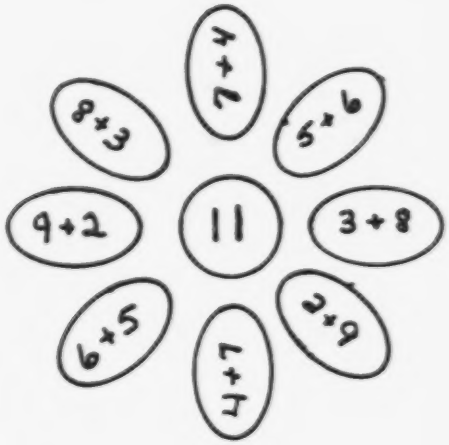
ADDITION FACTS

Addition Practice

Draw a flower, like the one shown, on the chalkboard.



Write a number in the middle, 11 for example. Have students, one at a time, give an addition fact with the answer 11. As it is given, write the fact on a petal. When it is complete, the flower might look like this.

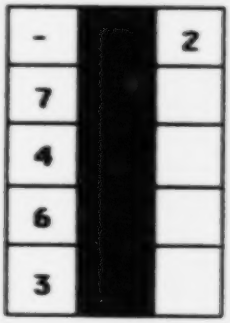


SUBTRACTION FACTS

Subtraction Practice

(For each student: standard chart with a computational rule at the top and a list of numbers on the left.)

Give each student a chart like one of those shown below. Have the student look at the rule on the top of the chart, follow this rule for each number on the left of the chart, and put the answers on the right.

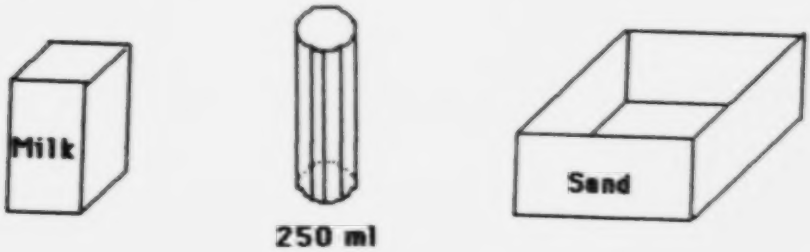


To make the task more challenging try a variation of the chart shown. Prepare some charts with a rule at the top, no numbers on the left, and answers on the right.

MEASUREMENT

Volume of Various Containers

(Empty milk cartons and empty cans of various sizes; sand; 250 ml container.)



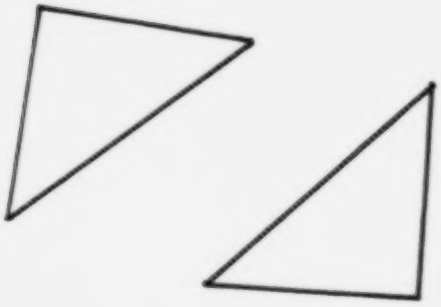
Children determine how many 250 ml containers of sand fill each container.

GEOMETRY

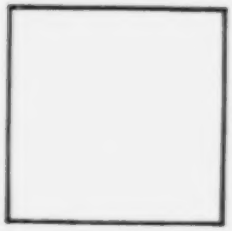
Changing Shapes

(Prepared sheets and scissors.)

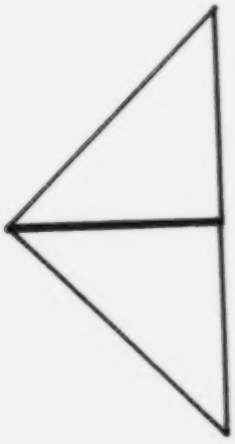
1. Cut out these shapes.



2. Use the triangles to make this shape.

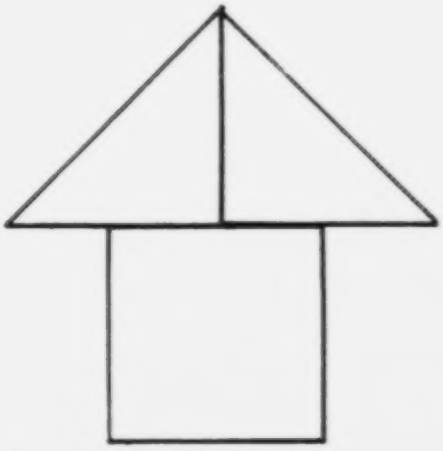


3. Use the triangles to make this shape.



4. Cut out the triangle in Exercise 3 and the square in Exercise 2.

   Use all four pieces to make this shape.



COUNTING, MONEY, AND TIME

What's In My Hand?

Number of Players: 2 teams

Materials: 1 quarter, 9 dimes, 9 nickels, and 9 pennies (for the teacher and each team).

Rules:

1. Separate the class into two teams.

2. Hold a group of coins in your hand and tell the students the total amount. For example, if you have 1 quarter, 1 nickel, 2 dimes, and 2 pennies in your hand, tell the students you are holding 52¢. Ask what coins you have.

3. The teams should now use an assortment of coins to try to determine which coins are in your hand.

4. Let each team guess the coins in turn.

5. As incorrect guesses are given, write them on the chalkboard and give a clue such as too many pennies, not enough dimes, etc.

6. The first team to guess the group of coins correctly gets a point. The team that gets 10 points first is the winning team.

Activities - Intermediate

NUMBERS AND PLACE VALUE

Building Numbers

(Set of number cards 0-9, paper and pencil for each child.) Each child prepares a grid.

Hundreds	Tens	Ones

The teacher draws a card from the cards which are face down on the table. He/She calls the number and each child chooses to write it in the place he/she thinks will result in building the largest number. The teacher draws a second number. Each child chooses another place to write that number. Continue until all places are filled on the grid. Compare the finished numbers to see who has the largest.

Variations: Build the smallest number.
Use a four-place grid.
Replace the drawn number into the deck each time it is drawn.

ADDITION AND SUBTRACTION

Magic Squares

In a magic square the sum of the numbers in each row, column, and diagonal is the same. The magic sum for the magic square is 27.

7	6	14	→ 27
16	9	2	→ 27
4	12	11	→ 27
↓ 27	↓ 27	↓ 27	↘ 27

27

Find the magic sum for the magic square.

14		28
32	18	
	24	22

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TIME AND MONEY

Menu Mathematics

Provide a menu for the students in your class to use. This could be done in several ways:

1. Duplicate a menu for each child.
2. Post one large menu on poster board so that it could be seen by all students.
3. Obtain old menus from local restaurants.
4. Let students create their own menu.

Let students order their own breakfast from the menu provided. Tell them they are allowed $10 for their meal. Have students figure their change and then check each other's computation.

BREAKFAST MENU

Brown Bear Special
(2 eggs, muffin, orange juice) $2.75

Waffles and Sausage Links $3.25

Pancakes $2.95

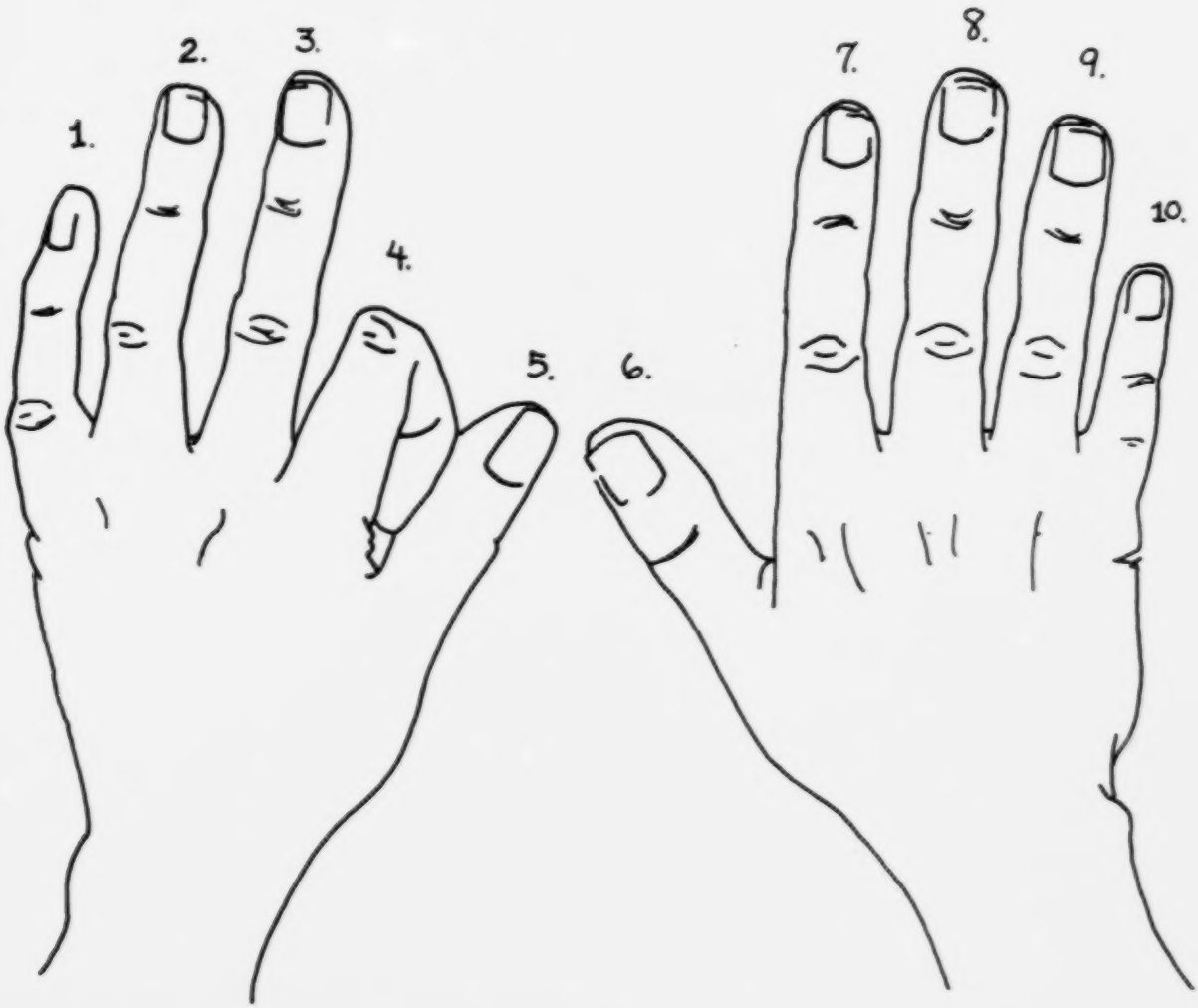
Cereal with fresh fruit. $1.95

Beverages		Side Orders	
Milk	$0.45	Fresh fruit	$0.95
Juice (orange or tomato)	$0.75	Egg (1)	$1.05
Coffee	$0.50	Ham or Sausage	$1.25

MULTIPLICATION

Multiplication by Nines

Show students how to multiply by 9s with their fingers. They should think of each finger as numbered in the picture. For 4 x 9, they bend down the finger numbered 4. The number of fingers to the left of the bent finger show the tens in the product (3). The number of fingers to the right show the ones (6). Have students demonstrate each fact of 9 using this method.

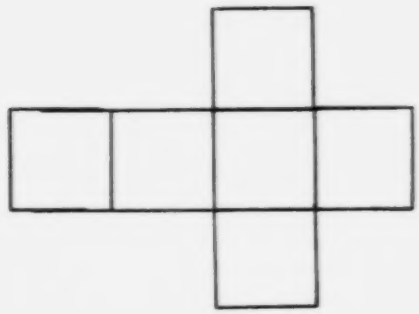


MEASUREMENT

Area

(Graph paper, scissors, glue)

Have each student build cubes, rectangular solids, prisms, etc. out of centimeter graph paper to help them develop concepts about measure of surface area.



Leave enough paper around the pattern to make tabs to glue the model together.

DIVISION

Division Tic-Tac-Toe

Number of Players: 2, with 1 referee

Materials: Sheet with division basic facts, an answer sheet for those facts.

Rules:

1. Players make a tic-tac-toe grid on paper and fill in the digits 1-9 in the spaces in any order.

2. The first player chooses any fact from the fact sheet and gives the quotient. The referee checks the answer.

6	5	9
8	1	3
2	7	4

3. If the answer is correct, the player marks an X or O in the space on the grid that has the same number as the quotient. The fact is then crossed off the sheet.

4. If the answer is incorrect, the player does not mark a number or cross off the fact.

5. The second player chooses a fact from those remaining on the sheet and gives the quotient. Play proceeds as in steps 2-4.

   NOTE: Players should choose facts with quotients that have not been marked on the grid.

6. The game continues until one player marks three numbers on the grid horizontally, vertically, or diagonally, or until the grid is full.

7. The players make up new tic-tac-toe grids and continue to play games until all the facts on the sheet have been crossed off or until no more plays are possible.

Scoring: A player scores one point for each game won. A game is won when a player marks three numbers in a row horizontally, vertically, or diagonally, or has marked the most spaces on the filled grid.

The Winner: The player with the most points.

GRAPHING

Interviewing

Have students build their own bar graphs. Let them write questions for their graphs and gather data from the class. The data could be about their favorite colors, their favorite sports, their pets, the number of brothers and sisters they have, or their favorite subjects.

GEOMETRY

The Volume V

Number of Players: 2-4

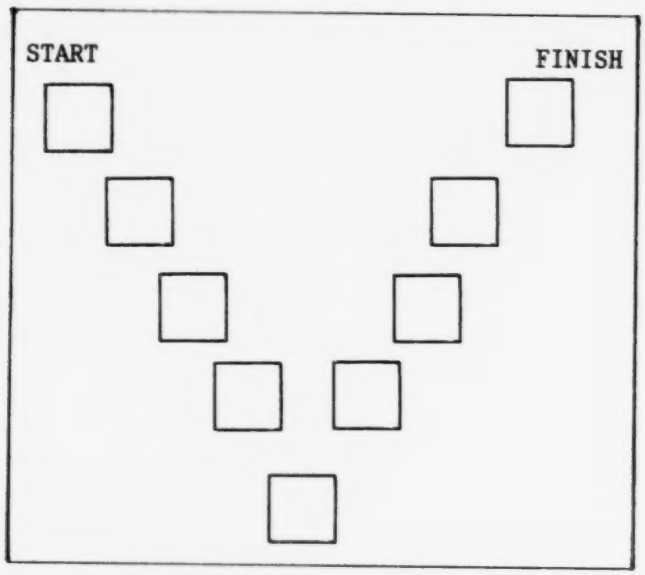
Materials: 50 volume exercise cards, Volume V game board, (see page III-14) 2-4 different game markers, calculator

Use index cards to make the volume exercise cards. On each, write a length, a width, and a height.

Length:	15 in.
Width:	12 in.
Height:	14 in.

(Sample Index Card)

To make the Volume V game board, use a large piece of poster board. Arrange rectangles on the board in the shape of a V. Write START at the beginning of the V and FINISH at the end.



Volume V
Game Board

Rules:

1. Exercise cards are placed face down in the center of the V on the game board.
2. All players put their markers on START.
3. The first player begins by taking the top card.
4. The player finds the volume, computing either mentally or on paper. Another player checks the answer using a calculator.
5. If the answer is correct, the player advances his/her marker one rectangle. The used card is placed in a discard pile.
6. Play continues with players taking turns as described.
7. If all cards have been used, but no player has reached FINISH, mix the used cards and place them face down on the board and continue play.

The Winner: The first player to reach FINISH.

Activities - Intermediate

DECIMALS AND FRACTIONS

Fishing for Fractions

Number of Players: 2-4

Materials: Deck of cards (amount determined by grade level) with one-half having fractions written on them, the other half having decimals equivalent to the fractions.

Suggested Use:
1) As in "Go Fish"
2) As in "Concentration"

Variations:
1) Deck of cards with pairs of equivalent fractions only.
2) Deck of cards with pairs of equivalent decimals only.

PROBLEM SOLVING

Eeny, Meeny, Miney, and Mo

There is a family with five children who are named Alexander, Kathryn, Marguerite, Pamela, and Peter. They have their own rooms which are painted blue, brown, green, white, and yellow. Four of the five children have pets: a cat, a dog, a fish, and a hamster. The children are in grades three, four, seven, eight, and ten. They have ambitions to become an artist, a dancer, a mathematician, a tennis player, and a writer.

The fourth grader has no pet. The mathematician has the brown room. The dancer has the dog. The seventh, eighth, and tenth graders have the green, white, and yellow rooms, but not in that order. Kathryn is in eighth grade and has a cat for a pet. The mathematician and the child with no pet are brothers in consecutive grades. Peter has a blue room. Marguerite is older than Pamela and keeps a fish in her room. The artist lives in the yellow room, and the artist is in a lower grade than the writer. The mathematician is four grades below the person with the dog. The person in the white room is in a higher grade than the person in the yellow room.

1. Who is the mathematician?

2. Who owns the dog?

3. Who is in the fourth grade?

4. Who has the yellow room?

5. Who wants to be a writer?

In case you are not totally confused, you might like to use the following chart as a way to organize your thoughts and the information which was given to you.

	Alexander	Kathryn	Marguerite	Pamela	Peter
Room Color					
Grade					
Pet					
Career Ambition					

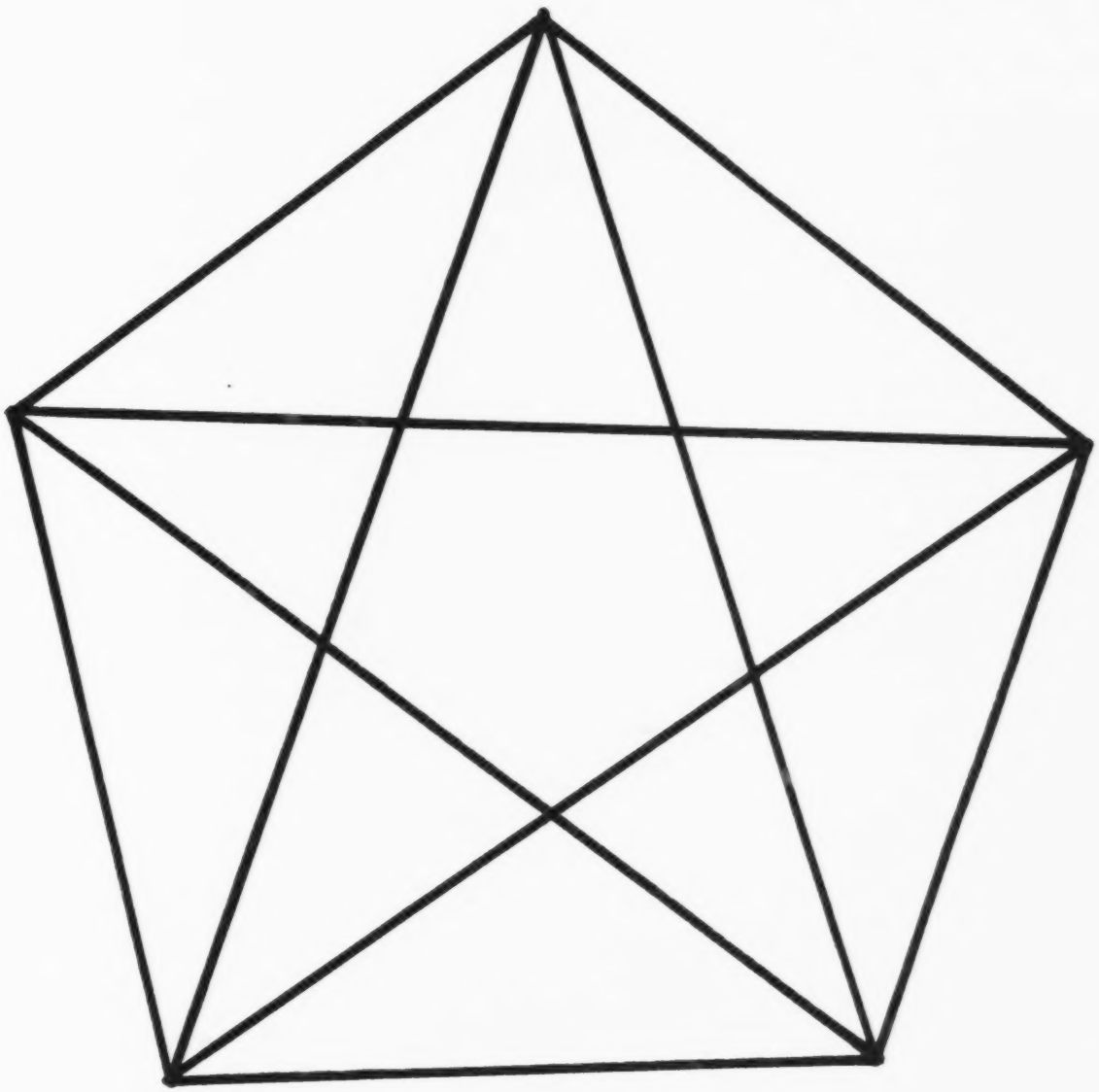
Solution to Eeny, Meeny, Miney, and Mo

	Alexander	Kathryn	Marguerite	Pamela	Peter
Room Color	Brown	Yellow	White	Green	Blue
Grade	3	8	10	7	4
Pet	Hamster	Cat	Fish	Dog	None
Career Ambition	Math	Artist	Writer	Dancer	Tennis Player

1. Alexander is the mathematician.
2. Pamela owns the dog.
3. Peter is in the fourth grade.
4. Kathryn has the yellow room.
5. Marguerite wants to be a writer.

BULLETIN BOARD IDEA

Below is a drawing of a pentagon with a star drawn on the inside. Determine how many triangles there are in the picture?

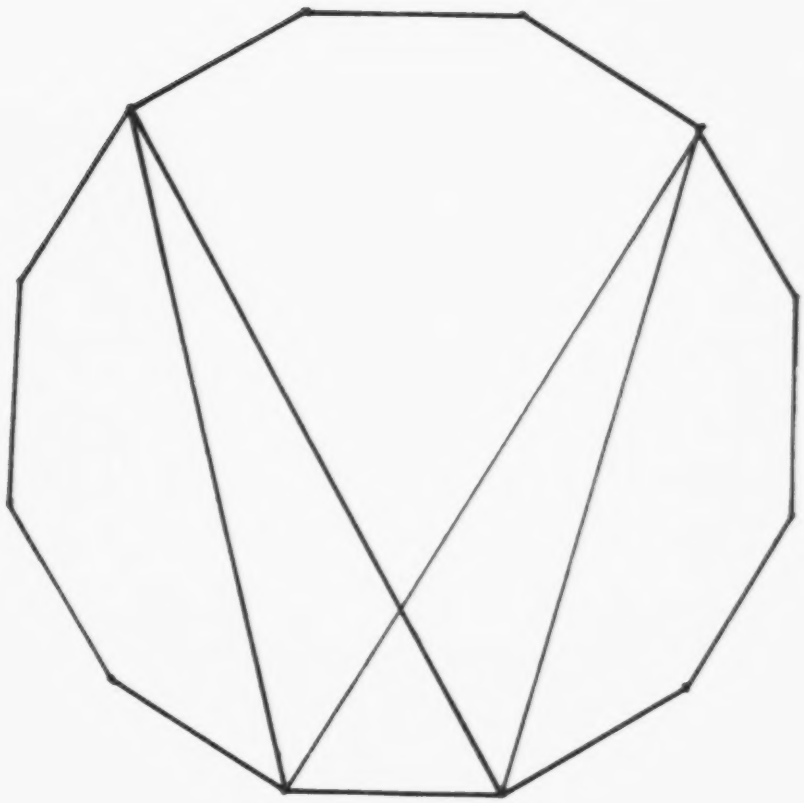


(Answer: There are 35 triangles in the picture!)

LEARNING CENTER IDEA - GEOMETRY

Square the Dodecagon

1. Cut out the pieces of the dodecagon. (You should end up with six pieces.)
2. Reassemble them to make a square.
3. Glue the pieces onto construction paper forming a square.

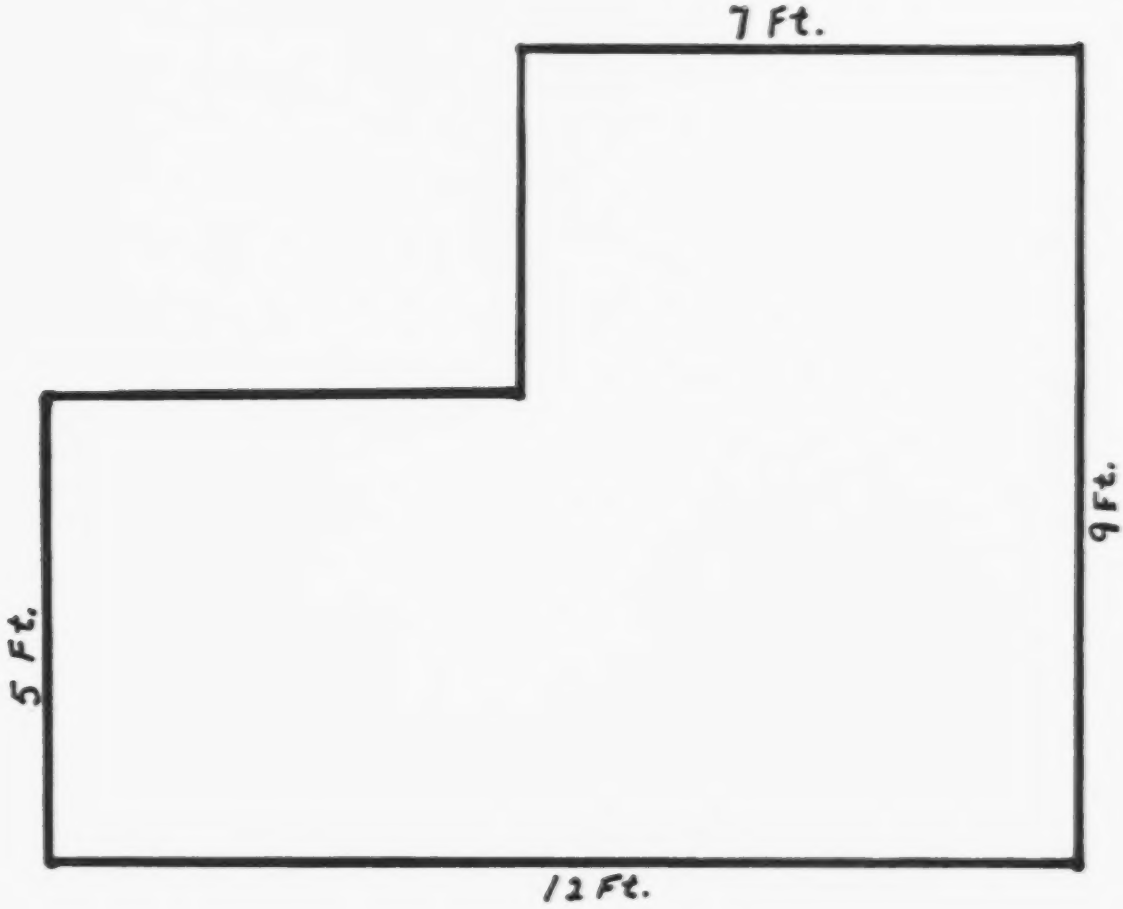


Activities - Intermediate

MEASUREMENT

Below is a diagram of a family room in your home. Your parents have told you that you can pick out the new carpet for this room, if you can determine how much carpet will be needed to cover the room (floor) and how much baseboard will be needed.

Can you determine how many feet each of these walls would be with the information given?



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WHOLE NUMBERS AND NUMBER THEORY

The Sieve of Eratosthenes

Materials: 1" graph paper
scissors

Rules:

1. Students are to number the squares in the following way:

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

2. Put a crown in the square over number 1 as it is neither prime nor composite.

3. Circle number 2, and then cut out the center of all the squares which are multiples of 2.

4. Circle number 3, and then cut out the center of all the squares which are multiples of 3.

5. Circle number 5, and then cut out the center of all the squares which are multiples of 5.

6. Repeat #5 for 7.

7. After sifting out the composite numbers, only primes will remain.

8. List these numbers on another paper.

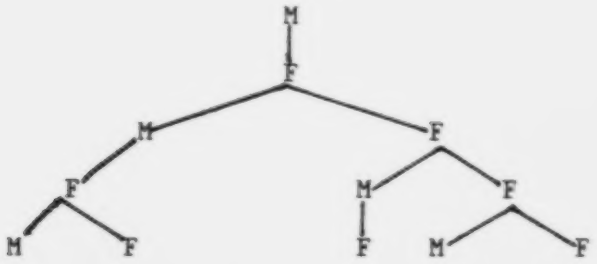
ADDITION AND SUBTRACTION

The Family Tree of a Female Bee
(The Fibonacci Sequence)

Rules:

1. Review the number pattern for the Fibonacci Sequence.

2. Draw part of the tree on the board.



3. Stress that only one branch extends from a "male," but two branches extend from a "female." The second row of the tree shows the parent and the third shows grandparents.

4. Students should continue the tree through the great-great-great-great grandparents.

MULTIPLICATION AND DIVISION

Map Math

Materials: Road maps

Rules:

1. Students use road maps to estimate distances between cities.

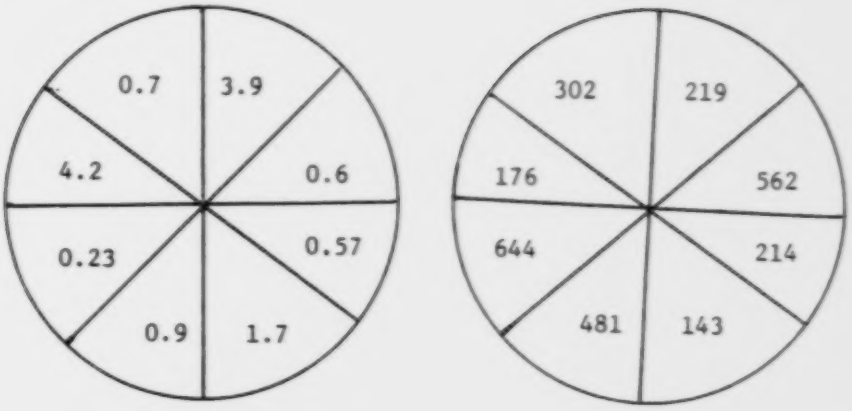
2. Have students round the distances to the nearest ten or the nearest hundred, whichever is more appropriate for the map being used.

3. Ask students to use their estimates to calculate how long it would take to travel from one city to another assuming an average speed of 50 mph.

DECIMALS

Operation Spin

Materials: 2 decimal spinners
To make the spinners, use circular pieces of cardboard and a felt-tip marker. On one spinner, write decimals up to the hundredths place. On the second, write whole numbers in the hundreds. Attach a cardboard pointer at the center of each circle with a paper fastener.



Number of Players: 2 or more

Rules:

1. The first player spins each spinner to get two numbers which he/she then multiplies.
2. Another player checks the multiplication. If correct, the product is the first player's score. If incorrect the score is zero.
3. The same procedure is followed by every player until 10 rounds have been played.
4. Highest total score is the winner.

MEASUREMENT

Dekameter Measure

Objective: To make a dekameter measure and use it to determine lengths and distances

Materials: rope, red tape

Draw on students' previous knowledge of metric units to complete this project. Use a meter stick and a length of rope to have students measure and cut one dekameter of rope. Each meter on the rope should be marked by wrapping red tape around it. Have students estimate distances and lengths of objects in the school yard that are about 1 dekameter long and then check their estimates with the dekameter measure. When the school yard items have been measured, let teams of students measure the length of the hallways in the school.

Activities - Junior High

Next, extend the project by having the teams estimate and then measure the length of the playground, perimeter of the building, and length of the gym. Have them develop a chart that includes a column for estimates in dekameters (to whole dekameters), a column for actual lengths (to whole dekameters), and a column for the difference between their estimate and the actual measurement.

When all groups have completed their measuring, the charts may be used for a variety of additional tasks. For example:

-- computing area of the schoolyard in square dekameters

-- computing area occupied by the school building in square dekameters

-- determining the ratio of the area occupied by the school building to the total area of the school (including grounds)

-- computing the volume of the classroom or entire school building in cubic dekameters

-- using tenths of dekameters to make more precise computations

-- converting between dekameters and meters, square dekameters, and square meters, and cubic dekameters, and cubic meters

-- estimating distances to nearby towns or cities or distances between landmarks within your community using dekameters

-- converting between dekameters and kilometers

Bulletin Board Suggestion:

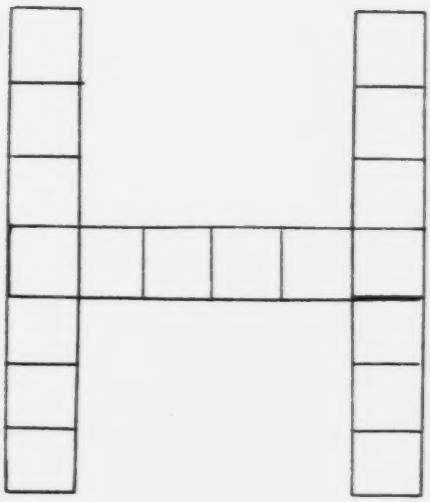
Students can create a bulletin board display using the statistics they have gathered about the spaces in their school. As later topics are developed, that information could be added to the display.

FRACTIONS

Whole Hog
(game for 2)

Materials: 10 cards, one each saying $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{6}$, $\frac{2}{6}$, $\frac{1}{9}$, $\frac{2}{9}$, $\frac{3}{9}$, $\frac{1}{18}$, $\frac{2}{18}$, $\frac{3}{18}$

a crayon for each
a sheet of paper for each with the following design



Rules:

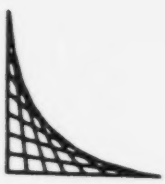
1. Place cards face down in a pile after mixing.
2. Each player picks a card from the top of the pile.
3. Turn cards over and decide which fraction is larger.
4. The player with the larger fraction colors that fractional part of his/her own H.
5. Place used cards at the bottom of the pile.
6. Draw two more cards and play as before.
7. If the player with the larger fraction cannot color the fractional part shown on the card, put both cards at the bottom of the pile and draw two more cards.
8. Continue. When one player has colored the whole H, that player says, "Whole Hog," and wins.

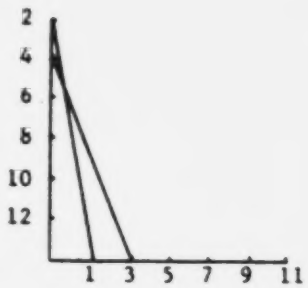
GEOMETRY

Line Designs

Materials: paper, pencil, ruler, colored pencils or pens

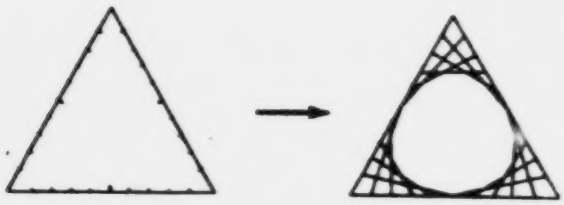
1. Complete the design by drawing straight lines to the corresponding numbers.



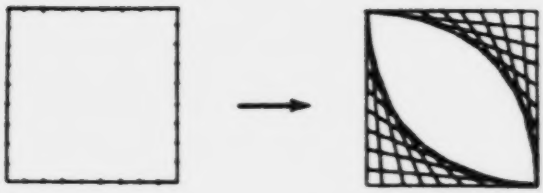


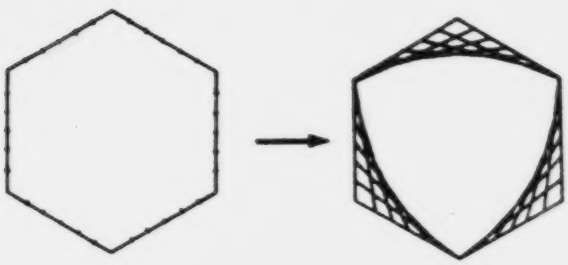
Activities - Junior High

2. More designs to complete.



Samples





Variations: 1) Have students make their own designs.

2) Make string designs.

RATIO, PROPORTION, PERCENT

Magic Percent

Number of Players: 3
Materials: 1 magic percent card, 19 fraction cards, 19 percent cards

Write "Magic Percent Card" on one card and write one of the fractions below on each of 19 cards and a corresponding percent on each of the other 19 cards.

$\frac{1}{4}$, 25%	$\frac{3}{4}$, 75%	$\frac{1}{2}$, 50%
$\frac{1}{5}$, 20%	$\frac{1}{10}$, 10%	$\frac{2}{5}$, 40%
$\frac{3}{5}$, 60%	$\frac{1}{3}$, $33\frac{1}{3}\%$	$\frac{4}{5}$, 80%
$\frac{3}{10}$, 30%	$\frac{2}{3}$, $66\frac{2}{3}\%$	$\frac{5}{5}$, 100%
$\frac{7}{10}$, 70%	$\frac{9}{10}$, 90%	$\frac{3}{50}$, 6%
$\frac{1}{100}$, 1%	$\frac{4}{25}$, 16%	$\frac{0}{10}$, 0%
$\frac{59}{100}$, 59%		

Rules:

1. One player mixes all the playing cards and passes them out, one card at a time. Each player gets 13 cards.

2. Players should hold the cards in their hands so that other players cannot see them.

3. Players should look in their hands for matching fraction and percent cards. For example, 25% matches 1/4. Any matching pairs in a player's hand can be placed face up on the table in front of the player. If the cards are matched incorrectly, they must be returned to the player's hand.

4. The first player selects a card from the hand of the player on the right. If the card selected matches any card he/she has, the matching pair is placed face up in front of the player. If the selected card does not match, the first player adds it to the hand.

5. Play continues in this way until all matching pairs are on the table.

Scoring: A player gets 2 points for each correctly matched pair. The player who is holding the "Magic Percent Card" at the end of the game gets 5 points.

The Winner: The player with the most points.

Variations: These matching fractions and percents can be used to make the game harder:

$\frac{1}{8}$ and $12\frac{1}{2}\%$	$\frac{7}{8}$ and $87\frac{1}{2}\%$
$\frac{3}{8}$ and $37\frac{1}{2}\%$	$\frac{1}{6}$ and $16\frac{2}{3}\%$
$\frac{5}{8}$ and $62\frac{1}{2}\%$	$\frac{5}{6}$ and $83\frac{1}{3}\%$

This game can be adapted for any skill that lends itself to matching, such as basic facts, equal measures, and equal fractions.

EQUATIONS AND GRAPHS

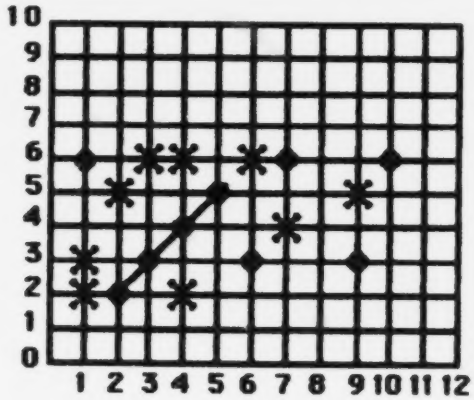
Tic-Tac-Toe With Ordered Pairs

Number of Players: 2

Materials: Graph paper, 22 number cards, paper sack

Use small squares of paper or cardboard to make the number cards. Label 11 of the number cards consecutively from 0-10, and repeat this with the other 11 cards. Put all the number cards in the sack.

Have students label each axis on their grids from 0-10. The picture shows a sample grid at the end of a game.



Rules:

1. This game is played similarly to tic-tac-toe. Two players share a grid.

2. The first player shakes the sack to mix the number cards. Without looking, this player draws two number cards from the sack and puts them together to form an ordered pair. The player can use either card for the first number of the ordered pair. He/She uses an X to mark the point on the grid and returns the cards to the sack.

3. The second player repeats rule 2, but he/she writes an 0 on the grid, instead of an X. If the point has already been marked, no new mark is made and the player loses this turn.

4. The players continue to alternate turns.

The Winner: The first player to get four X's or four 0's in a row, column, or on a diagonal.

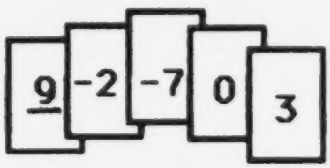
Variations: After students have learned how to locate points in four quadrants, use a four-quadrant grid. Label each scale from -5 to +5, and make two cards for each of the integers from -5 to +5.

INTEGERS

Integer Strategy

Number of Players: 2-4 in each group

Materials: 52 integer cards for each group of players. The 52 integer cards include two sets of cards showing positive integers from 1 through 12, two sets of cards showing negative integers from -1 through -12, and four cards showing zero.



Rules:

1. The first player chooses an "out-come" number and writes it on a piece of paper.

2. The first player then gives five cards to each player.

3. Each player must discard one card and use the remaining four cards. The object of the game is for each player to use any combination of operations necessary to get the "out-come" number from the cards he or she holds. Sometimes, there is no way to get this number from a hand. Often, there may be several ways to get the number. For example, if 9, -2, -7, 0, and 3 are the cards held and the "out-come" number is 12, the following plays can be made:

   a) Discard 0
      Then $(9 \div 3) - (-7) - (-2) = 12$

   b) Discard 9
      Then $[3 - (-7)] - (-2) + 0 = 12$

   c) Discard 0
      Then $3[9 + (-7) - (-2)] = 12$

   d) Discard -7
      Then $(3 + 9) + (-2)(0) = 12$

4. Play continues until a predetermined number of rounds has been played.

Scoring: Each player who gets the "out-come" number wins a point for that round. The player with the highest score at the end of the game is the winner.

STATISTICS AND PROBABILITY

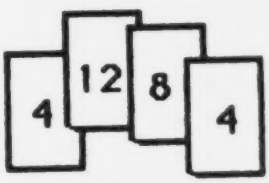
Mean Challenge

Number of Players: 2-4

Materials: 48 cards showing each of the numbers 1-12 four times.

Rules:

1. One player mixes the deck, gives four cards to each player, and puts the remaining cards face down in the center of the table. Players mentally determine the mean of the four numbers on their cards.



Mean is 7

2. Moving clockwise from the first player, the players in turn can do one of two things: They can put down the four cards and state the mean; or, they can discard up to four cards, take an equal number of new cards (in hope of getting a higher mean), and then display the new cards while stating the mean.

3. The player with the highest mean wins the round. In case of ties, each player holding the highest mean wins.

4. Any player can challenge the winning mean. If the challenger can show that the mean is incorrect, the challenger is the winner.

5. Change dealer each round.

6. Award 1 point to the winner, or winners, each round.

7. At the end of a predetermined number of rounds, the player with the highest score wins.

Variations: 1) To make the game more challenging, use higher numbers on the cards.

2) To make the game easier, give each player fewer cards or let players use paper and pencil to determine the means.

APPENDIX A

CALCULATORS IN MATHEMATICS EDUCATION

The widespread availability and use of calculators cannot be ignored when developing a State Curriculum Guide. Calculators are now accepted as efficient tools for computation. Because of their use and place in society and their value in teaching and learning mathematics, calculators must be incorporated into the school mathematics program.

The National Council of Teachers of Mathematics continues to endorse the minicalculator as a valuable instructional aid for mathematics education and to recommend the use of the minicalculator in the classroom. NCTM has published the following position statement: "With the decrease in the cost of the minicalculator, its accessibility to students at all levels is increasing rapidly. Mathematics teachers should recognize the potential contribution of this calculator as a valuable instructional aid. In the classroom, the minicalculator should be used in imaginative ways to reinforce learning and to motivate the learner as he/she becomes proficient in mathematics."

The Council's Instructional Affairs Committee identified nine ways in which the minicalculator can be used in classrooms:

1. To encourage students to be inquisitive and creative as they experiment with mathematical ideas.

2. To assist the individual to become a wiser consumer.

3. To reinforce the learning of the basic number facts and properties in addition, subtraction, multiplication, and division.

4. To develop the understanding of computational algorithms by repeated operations.

5. To serve as a flexible "answer key" to verify the results of computation.

6. To promote student independence in problem solving.

7. To solve problems that previously have been too time-consuming or impractical to be done with paper and pencil.

8. To formulate generalizations from patterns of numbers that are displayed.

9. To decrease the time needed to solve difficult computations.

In the National Council of Teachers of Mathematics an Agenda for Action: Recommendations for School Mathematics of the 1980s, we find the following actions:

3.1 All students should have access to calculators and increasingly to computers throughout their school mathematics program.

3.2 The use of electronic tools such as calculators and computers should be integrated into the core mathematics curriculum. Calculators should be available for appropriate use in all mathematics classrooms, and instructional objectives should include the ability to determine sensible and appropriate uses. Calculators and computers should be used in imaginative ways for exploring, discovering, and developing mathematical concepts and not merely for checking computational values or for drill and practice.

From the primary grades on, calculators should be used for exploratory activities. As students understand basic concepts and learn the basic arithmetic operations, they should be taught how and when to use the calculator. As more experience is gained, effective use of calculators should greatly increase. As this happens, it is especially important to emphasize understanding of place value and to emphasize that the results of the calculation must be reasonable.

In the upper elementary grades, students should be performing computations with calculators on a regular basis. At the same time, they should learn that for some simple computations, use of the calculator is cumbersome and can obscure the understanding of the concepts. As they gain experience, students should be expected to judge whether use of the calculator will be effective and efficient. Before the end of the sixth grade, students should have calculators continuously available for use in class, on homework assignments, and on tests. By the time students move into secondary schools, the use of calculators should be routine.

Calculators cannot serve as a substitute for good teaching, nor for use of concrete manipulatives in the classroom. They should not be used for "busy work" drill and practice. Most important, the use of calculators must not replace the development of the students' understanding of the meaning of arithmetic operations and the common algorithms used to perform those computations. With full and appropriate use of the calculator, all students can have the time and instructional support to learn to think through problems, knowing that lengthy computations will not be a barrier to success.

Classroom sets of calculators should be available for student use in all schools and their use integrated into the mathematics curriculum.

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Weaver, J. F. "Calculators and Unary Operations." School Science and Mathematics. 1981 (March), 81:567-573.

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APPENDIX B

COMPUTERS IN MATHEMATICS EDUCATION

With computers now readily available in most schools, and with the increasing availability of good software, it is clear that computers will become major tools of education. With the continuing efforts by the computer industry to provide "user friendly" software, schools no longer need an expert programmer to make use of current computer technology. The problem becomes one of proper utilization of this technology. The best role of computers in the educational process must be assessed by each school. The purpose of this section is to attempt to provide an overview of various activities involving computers that may be useful in a mathematics curriculum. The text of this section is followed by a listing of reviewers of educational computer software and guides available for help in reviewing software. Also included is a "Request for Information Form Letter," a "Software Evaluation Checklist" and a "Software Documentation Sheet."

The computer can assist instruction in three ways. First, software is available to supplement "Drill and Practice" exercises. "Drill and Practice" can be defined as those exercises used to provide routine practice of an objective or set of objectives. They are designed to reinforce and/or remediate previously learned skills and knowledges. These software programs are electronic versions of worksheets and are designed to provide immediate feedback to students. Many of the drill and practice programs provide various levels of drill as well as a student management component which records student performance and make reports available to the teacher.

Drill and practice programs can be used to reinforce concepts at both the elementary and secondary level. These programs provide the student with additional methods of practicing and reinforcing basic skills. Programs are available to supplement traditional elementary classroom activities such as those dealing with fractions, speed drills, arithmetic operations, money, statistics, and geometry. At the secondary level, activities may include solving of binomial expressions, linear equations, quadratic equations, statistical analysis and trigonometric calculations in addition to graphing functions. These programs are not meant to supplant, but rather to supplement teacher-student interaction. These computer exercises can be done individually or in small groups.

The computer may be used as a tutorial aid. This can be accomplished either through Computer Assisted Instruction (CAI) packages or commercially prepared software. The CAI programs can often be time consuming for the teacher to prepare properly and necessitate the clear determination of the objectives to be taught. Since these programs originate in the school, they will address specific school objectives. Commercially prepared tutorial software may be more expensive and may not address the specific objectives desired. Commercial software is usually more "professionally" presented and therefore may present the vendor's objectives more completely and clearly.

Tutorial programs can be very useful for individualized instruction. A properly chosen program can be useful for enriching the talented student, or remediating the slower student. Programs can be used to introduce topics that are not normally covered in a particular course or grade level. For example, a program can be used a) to introduce additional multiplication facts to an advanced second grade student; b) to give additional help to a fourth grade student having difficulty with fractions; c) to aid a sixth grade student who is having trouble with long division; d) to introduce an advanced eighth grade student to beginning algebra; e) to assist a twelfth grade student who has not taken math their senior year, to "brush up" on the metric system or basic algebra.

Finally, the computer can be used to enhance problem solving techniques through the use of simulations, spreadsheets, and programming. Simulations create a variety of opportunities for stimulating student involvement in problem solving. Simulations are game-like activities that allow students to make decisions, and interact in situations that are often too complex, historical, expensive, or distant to bring into the classroom. They are computer-based models of real-life situations which allow students to control certain variables and provide ways of checking their hypothosis about those variables. Programs may or may not be directly related to math, but their end results, i.e., hypothesis-forming and testing, are consistent with skills addressed in most math curricula.

A second method of developing problem solving techniques is through the use of spreadsheets. Spreadsheets allow the student to input data, perform calculations on the data, and to organize the results in a meaningful way. For example, students may input various interest rates for paying back a loan, calculate the monthly payments, and finally organize the data to relate interest rate with monthly payment. The spreadsheet can also be used to perform various calculations with a function and then list the results, and finally organize the results to see relationships between the variables and function. This type of exercise allows the student to focus specifically on relationships without getting involved in tedius time consuming calculations.

A final method to improve the problem solving abilities of students is to have them create their own programs. This does not necessitate developing an extensive ability to program, but rather may simply involve the utilization of a limited number of commands of one language such as BASIC or LOGO. These commands are then used to perform specific tasks such as calculating the monthly balance on a car loan or forming a geometric figure. Programming forces the student to define the problem, formulate, implement, and evaluate a plan. This can be accomplished in a nonthreatening environment, with immediate feedback and reinforcement while challenging the student's creativity.

In teaching mathematics, as with any subject, educators must be aware of individual learning styles. The computer is one tool that can be used to facilitate the learning of mathematics. It should be used to extend and enrich the learning experiences available to students.

Reviewers of Computer Software

EPIE (Education Products Information Exchange). EPIE Institute, Box 620, Stony Brook, NY 11790.

MICROSIFT (Microcomputer Software Information for Teachers). Computer Technology Program, Northwest Regional Educational Laboratory, 300 Southwest Sixth Avenue, Portland, OR 97204.

Minnesota Educational Computing Consortium (MECC). MECC, Instructional Systems Development, 2520 Broadway Drive, St. Paul, MN 55113.

School Microware: A Directory of Educational Software. Dresden Associates, P.O. Box 246, Dresden, ME 04342.

Additional Guides for Evaluating Software

AEDS MONITOR 20 (April, May, June, 1982).

Microcomputer Software for Instructional Use: Where are the Critical Reviews?" by Ann Lathrop, The Computing Teacher 9 (February, 1982): 22-26.

SAMPLE REQUEST-FOR-INFORMATION FORM LETTER

_____
_____
_____

Dear _____:

We wish to evaluate certain of your computer programs for possible purchase. This evaluation would include any related teacher- or student-support materials. The following programs are of specific interest:

_____ _____
_____ _____
_____ _____

Before requesting the programs themselves, we need information (brochures, technical reports, or your comments) to answer the following questions:

1. What are the system and memory requirements for each program's use?
2. On what media (disks, cassette tape, cartridge, etc.) is each program available?
3. In what computer language(s) is each program written?
4. For which grade levels or ability levels is each program intended?
5. What are the specific content areas or instructional objectives for each program?
6. Has each program been tested or validated in a classroom setting?
7. What kind of instructional materials are available to support a given program's use? What is the cost of such materials?
8. What is the procedure or cost for obtaining each program for a full review?
9. What is the purchase price of each program?

Please send this information to:

_____
_____
_____

Thank you for your assistance.

Sincerely,

_____
_____

SOFTWARE EVALUATION CHECKLIST

PROGRAM NAME: _____ SOURCE: _____ COST: _____

SUBJECT AREA: _____ REVIEWER'S NAME: _____ DATE: _____

EMC: 1/86

1. INSTRUCTIONAL RANGE

_____ grade level(s)

_____ ability level(s)

2. INSTRUCTIONAL GROUPING FOR PROGRAM USE

_____ individual

_____ small group (size: _____)

_____ large group (size: _____)

3. EXECUTION TIME

_____ minutes (estimated) for average use

4. PROGRAM USE(S)

_____ drill or practice

_____ tutorial

_____ simulation

_____ instructional gaming

_____ problem solving

_____ informational

_____ other (_____)

5. USER ORIENTATION: INSTRUCTOR'S POINT OF VIEW

low				*high*	
•	•	•	•	•	flexibility
•	•	•	•	•	freedom from need to intervene or assist

6. USER ORIENTATION: STUDENT'S POINT OF VIEW

low				*high*	
•	•	•	•	•	quality of directions (clarity)
•	•	•	•	•	quality of output (content and tone)
•	•	•	•	•	quality of screen formatting
•	•	•	•	•	freedom from need for external information
•	•	•	•	•	freedom from disruption by system errors
•	•	•	•	•	simplicity of user input

7. CONTENT

low				*high*	
•	•	•	•	•	instructional focus
•	•	•	•	•	instructional significance
•	•	•	•	•	soundness or validity
•	•	•	•	•	compatibility with other materials used

8. MOTIVATION AND INSTRUCTIONAL STYLE

passive				*active*	
•	•	•	•	•	type of student involvement

low				*high*	
•	•	•	•	•	degree of student control

none	*poor*			*good*	
•	•	•	•	•	use of game format
•	•	•	•	•	use of still graphics
•	•	•	•	•	use of animation
•	•	•	•	•	use of color
•	•	•	•	•	use of voice input and output
•	•	•	•	•	use of nonvoice audio
•	•	•	•	•	use of light pen
•	•	•	•	•	use of ancillary materials
•	•	•	•	•	use of _____

9. SOCIAL CHARACTERISTICS

present and negative	*not present*	*present and positive*	
_____	_____	_____	competition
_____	_____	_____	cooperation
_____	_____	_____	humanizing of computer
_____	_____	_____	moral issues or value judgments
_____	_____	_____	summary of student performance

B-5

170

171

DIRECTIONS FOR SOFTWARE EVALUATION CHECKLIST

1. The grade levels and ability levels for a particular program are primarily determined by the concepts involved. Other important factors are reading level, prerequisite skills, degree of student control, and intended instructional use. It is possible for a program to be flexible enough to be used across a wide range of grade levels and ability levels.

2. Some programs are designed for use by individuals. Others have been or can be modified for participation by two or three persons at a time. Simulations or demonstrations often pose opportunities for large-group interaction. A given program may be used in more than one grouping, depending on the instructor.

3. The time required for the use of a program will vary considerably. Include loading time for cassettes. A time range is the appropriate response here.

4. Instructional programs can be categorized according to their uses. Some programs may have more than one use, thus falling into more than one of the following categories:
   Drill or practice: Assumes that the concept or skill has been taught previously.
   Tutorial: Directs the full cycle of the instructional process; a dialogue between the student and the computer.
   Simulation: Models selected, alterable aspects of an environment.
   Instructional gaming: Involves random events and the pursuit of a winning strategy.
   Problem solving: Uses general algorithms common to one or more problems.
   Informational: Generates information (data).

5. These are factors relevant to the actual use of the program from the point of view of an instructor.
   Flexibility: A program may allow the user or the instructor to adjust the program to different ability levels, degrees of difficulty, or concepts.

   Intervention or assistance: A rating of "low" means considerable teacher intervention or assistance is required.

6. These are factors relevant to the actual use of the program from the point of view of a student.
   Directions: The directions should be complete, readable, under the user's control (e.g., should not scroll off the screen until understood), and use appropriate examples.

   Output: Program responses should be readable, understandable, and complete. If in response to student input, the output should be of an acceptable tone and consistent with the input request.

   Screen formatting: The formats during a program run should not be distracting or cluttered. Labels and symbols should be meaningful within the given context.

   External information: A program may require the user to have access to information other than that provided within it. This may include prerequisite content knowledge or knowledge of conventions used by the program designer as well as maps, books, models, and so on.

   System errors: System errors result in the involuntary termination of the program.

   Input: A program should ensure that a user knows when and in what form input is needed. It should avoid using characters with special meanings, restrict input locations to particular screen areas, and require minimal typing.

7. These are matters relevant to the subject-matter content of the program.
   Focus: The program topic should be clearly defined and of a scope that permits thorough treatment.

   Significance: The instructional objectives of the program must be viewed as important by the instructor. Also, the program should represent a valid use of the computer's capabilities while improving the instructional process.

   Soundness or validity: The concepts and terms employed should be correct, clear, and precise. Other important factors are the rate of presentation, degree of difficulty, and internal consistency.

   Compatibility: The content, terminology, teaching style, and educational philosophy of the program should be consistent with those generally encountered by the student.

9. Competition, cooperation, and values are concerns that may be a function of the way a program expresses them. (War gaming and the "hangman" format are sample issues.) Also, the "humanizing" of the computer may serve for motivation or to reduce anxiety, but it also may become tedious, misleading, and counterproductive.

The summary of student performance can be dichotomous (win or lose), statistical (time expended or percent of items correct), or subjective (as in the evaluation of a simulation). It may be for student, teacher, or both.

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B-6

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SAMPLE SOFTWARE DOCUMENTATION SHEET

PROGRAM NAME: _____

SUBJECT AREA: _____

PROGRAM CLASS

____ isolated program

____ part of a ____ program cluster

INTENDED AUDIENCE(S)

____ teachers

____ students in grade(s) _____

____ other _____

_____ _____

PROGRAM USES: (1 = primary, 2 = secondary)

____ drill or practice

____ tutorial

____ simulation

____ instructional gaming

____ problem solving

____ informational

____ other _____

_____

CRITICAL PREREQUISITE SKILLS

_____

_____

NAME(S) OF PREREQUISITE PROGRAM(S)

_____

_____

_____

NAME(S) OF FOLLOW-UP PROGRAM(S)

_____

_____

_____

DATE OF THIS DOCUMENTATION

_____

PROGRAM SOURCE

name: _____

address: _____

_____

_____

phone: _____

program cost: _____

SYSTEM REQUIREMENTS

computer: _____

language: _____

memory needed: _____ bytes

input mode: cassette

____-inch diskette

cartridge

other _____

_____

output mode: color monitor

B/W monitor

printer

plotter

other _____

_____

CLASSROOM VALIDATION (describe)

_____

_____

_____

TIME FOR AVERAGE EXECUTION ____ minutes

OVER

EMC: 1/86

GENERAL DESCRIPTION OF THE PROGRAM (i.e., purpose of the program)

SPECIAL PROGRAM CHARACTERISTICS (e.g., use of graphics or sound, designed for use by groups of two or more persons at a time, level of difficulty can be modified by teacher (only) or student, exit from program is controlled by the teacher (only) or student, etc.)

DIRECTIONS FOR USE OF THE PROGRAM (e.g., directions not presented in the program itself but needed for program execution, directions regarding the use of the program within the total instructional process, notes regarding program options, etc.)

ANCILLARY MATERIALS REQUIRED (e.g., books, worksheets, charts, data lists, dice, geometric shapes, lab equipment, etc.)

ADDITIONAL DOCUMENTATION AVAILABLE (check box for each type)

- ☐ sample run (location _____)
- ☐ program listing (location _____)

APPENDIX C

MATHEMATICS TEXTBOOK EVALUATION

The procedure for textbook evaluation will vary depending on the size of the school and other factors unique to each school. In smaller schools, textbook selection may be the responsibility of one or two individuals, while in the larger schools a selection committee is usually formed. In either case the selection process should involve as many people as feasible.

The selection process usually becomes more detailed when committees are involved. However, there are certain general procedures usually followed regardless of the size of the selection committee. These might involve:

considering objectives,
selecting the evaluating committee,
developing evaluative criteria,
complying with legal provisions,
developing a rating form.

The evaluative criteria usually lead to the development of a rating form. The rating form often includes a rating scale which reflects the relative importance of each criterion in the rating process.

Criteria usually included on a rating form are:

content,
organization,
auxiliary materials,
physical characteristics,
special considerations.

In developing a rating form involving these criteria, a percent is attached to each criterion to establish its relative weight. For example, a rating of 1 to 5 could be applied to each criterion. By multiplying the relative weight (percent) by the rating (1 to 5) a weighted rating is established for each criterion. The weighted ratings of the criteria are totaled to produce an overall rating. This overall rating would then be a number from 1 to 5. A sample rating form follows.

TEXTBOOK EVALUATION FORM

Course Title _____

Textbook Title _____

Authors _____

Publisher _____

Copyright Date _____

Evaluator's Name _____

OVERALL RATING

CRITERION	Weight (%)	x	Rating	=	Weighted Rating
Content	_____	x	_____	=	_____
Organization	_____	x	_____	=	_____
Auxiliary Material	_____	x	_____	=	_____
Readability	_____	x	_____	=	_____
Physical Characteristics	_____	x	_____	=	_____
Other Considerations	_____	x	_____	=	_____
Must Total 100%	_____	x	_____	=	_____
	OVERALL RATING				_____

(Sum of the weighted rating will be a number from 1 to 5.)

A more comprehensive explanation of this procedure can be found in a handbook entitled The Evaluation of Mathematics Textbooks, which is available from: The National Council of Teachers of Mathematics, 1906 Association Drive, Reston, VA 22091.

APPENDIX D

NCSM POSITION PAPER ON BASIC SKILLS

The currently popular slogan "Back to the Basics" has become a rallying cry of many who perceive a need for certain changes in education. The result is a trend that has gained considerable momentum and has initiated demands for programs and evaluations which emphasize narrowly defined skills.

Mathematics educators find themselves under considerable pressure from boards of education, legislatures, and citizens' groups who are demanding instructional programs which will guarantee acquisition of computational skills. Leaders in mathematics education have expressed a need for clarifying what are the basic skills needed by students who hope to participate successfully in adult society.

Any list of basic skills must include computation. However, the role of computational skills in mathematics must be seen in the light of the contributions they make to one's ability to use mathematics in everyday living. In isolation, computational skills contribute little to one's ability to participate in mainstream society. Combined effectively with the other skill areas, they provide the learner with the basic mathematical ability needed by adults.

The National Council of Supervisors of Mathematics (NCSM) views basic mathematical skills as falling under ten vital areas. The ten skill areas are interrelated and many overlap with each other and with other disciplines. All are basic to pupils' development of the ability to reason effectively in varied situations.

This expanded list is presented with the conviction that mathematics education must not emphasize computational skills to the neglect of other critical areas of mathematics. The ten components of basic mathematical skills are listed below, but the order of their listing should not be interpreted as indicating either a priority of importance or a sequence for teaching and learning.

Furthermore, as society changes our ideas about which skills are basic also change. For example, today our students should learn to measure in both the customary and metric systems, but in the future the significance of the customary system will be mostly historical. There will also be increasing emphasis on when and how to use hand-held calculators and other electronic devices in mathematics.

Certainly drill and practice is a viable option for development of basic skills, but it is only one of many possible ways to bring about learning and to create interest and motivation in students. Learning centers, contracts, tutorial sessions, individual and small-group projects, games, simulations and community-based activities are some of the other options that can provide the opportunity to learn basic skills. Furthermore, to help students fully understand basic mathematical concepts, teachers should utilize the full range of activities and materials available, including objects the students can actually handle.

Because they do not supply sufficient information about how much mathematics a student knows, standardized tests are not the best instruments available for reporting individual pupil growth. Other alternatives such as criterion tests or competency tests must be considered. In criterion tests, items are generated which measure the specific objectives of the program and which establish the student's level of mastery of these objectives. Competency tests are designed to determine if the individual has mastered the skills necessary for a certain purpose such as entry into the job market. There is also need for open-ended assessments such as observations, interviews, and manipulative tasks to assess skills which paper and pencil tests do not measure adequately.

Large scale testing, whether involving all students or a random sample, can result in interpretations which have great influence on curriculum revisions and development. Test results can indicate, for example, that a particular mathematical topic is being taught at the wrong time in the student's development and that it might better be introduced later or earlier in the curriculum. The results might indicate that students are confused about some topic as a result of inappropriate teaching procedures. In any case, test results should be carefully examined by educators with special skills in the area of curriculum development.

The present paper represents a preliminary attempt by the National Council of Supervisors of Mathematics to clarify and communicate its position on basic mathematical skills. The NCSM position establishes a framework within which decisions on program planning and implementation can be made. It also sets forth the underlying rationale for identifying and developing basic skills and for evaluating pupils' acquisition of these competencies. The NCSM position underscores the fundamental belief of the National Council of Supervisors of Mathematics that any effective program of basic mathematical skills must be directed not "back" but forward to the essential needs of adults in the present and future.

Ten Basic Skill Areas

1. Problem solving
2. Applying mathematics to everyday situations
3. Alertness to the reasonableness of results
4. Estimation and approximation
5. Appropriate computational skills
6. Geometry
7. Measurement
8. Reading, interpreting, and constructing tables, charts, and graphs
9. Using mathematics to predict (probability and statistics)
10. Computer literacy

APPENDIX E

SUMMARY OF NCTM AN AGENDA FOR ACTION

Recommendations for
School Mathematics of the 1980s

Recommendation 1

PROBLEM SOLVING MUST BE THE FOCUS OF SCHOOL MATHEMATICS IN THE 1980s

Problem solving encompasses a multitude of routine and commonplace as well as nonroutine functions considered to be essential to the day-to-day living of every citizen. But it must also prepare individuals to deal with the special problems they will face in their individual careers.

Recommended Actions

1. The mathematics curriculum should be organized around problem solving.

2. Mathematics teachers should create classroom environments in which problem solving can flourish.

3. Appropriate curricular materials to teach problem solving should be developed for all grade levels.

4. Mathematics programs of the 1980s should involve students in problem solving by presenting applications at all grade levels.

Recommendation 2

THE CONCEPT OF BASIC SKILLS IN MATHEMATICS MUST ENCOMPASS MORE THAN COMPUTATIONAL FACILITY

There must be an acceptance of the full spectrum of basic skills and recognition that there is a wide variety of such skills beyond mere computational skills if we are to design a basic skills component of the curriculum that enhances rather than undermines education.

Common sense should dictate a reasonable balance among mental facilities with simple basic computations, paper-and-pencil algorithms for simple problems done easily and rapidly, and the use of calculators for more complex problems or those where problem analysis is the goal and cumbersome calculating is a limiting distraction.

*Copy of Agenda for Action available for $1.00 per copy from NCTM, 1906 Association Drive, Reston, VA 22091.

Professional knowledge of future trends; industrial, financial, engineering, and scientific needs, and the demands of daily life are all better arbiter of what is currently essential and what has become obsolete than our nostalgia as parents or teachers.

Recommended Actions

1. The full scope of what is basic should contain at least the ten basic skill areas identified by the National Council of Supervisors of Mathematics "Position Paper on Basic Skills." These areas are 1) problem solving; 2) applying mathematics in everyday situations; 3) alertness to the reasonableness of results; 4) estimation and approximation; 5) appropriate computational skills; 6) geometry; 7) measurement; 8) reading, interpreting, and constructing tables, charts, and graphs; 9) using mathematics to predict; and 10) computer literacy.

2. Teachers should incorporate estimation activities into all areas of the program on a regular and sustaining basis, in particular encouraging the use of estimating skills to pose and select alternatives and to assess what a reasonable answer may be.

3. Teachers should provide ample opportunities for students to learn communication skills in mathematics. They should systematically guide students to read mathematics and to talk about it with clarity.

Recommendation 3

MATHEMATICS PROGRAMS MUST TAKE FULL ADVANTAGE OF THE POWER OF CALCULATORS AND COMPUTERS AT ALL GRADE LEVELS

It is recognized that a significant portion of instruction in the early grades must be devoted to the direct acquisition of number concepts and skills without the use of calculators. However, when the burden of lengthy computations outweighs the educational contribution of the process, calculators should become readily available.

With the increasing availability of microcomputers at decreasing costs, it is imperative that schools play an active part in preparing students of the 1980s to live in a world in which more and more functions are being performed by computers.

Recommended Actions

1. All students should have access to calculators and increasingly to computers throughout their school mathematics programs.

2. The use of electronic tools such as calculators and computers should be integrated into the core mathematics curriculum.

3. Secondary school computer courses should be designed to provide the necessary background for advanced work in computer science.

4. School administrators and teachers should initiate interaction with the parents to achieve maximum benefit to the students through the coordinated home and school use of computers and calculators.

5. Teachers of other school subjects in which mathematics is applied should make appropriate use of calculators and computers in their instructional programs.

6. Certification standards should include preparation in computer literacy and the instructional uses of calculators and computers.

Recommendation 4

STRINGENT STANDARDS OF BOTH EFFECTIVENESS AND EFFICIENCY MUST BE APPLIED TO THE TEACHING OF MATHEMATICS

Modern technology and educational theory and research have made accessible to today's teachers approaches, materials and strategies that were not previously available. Teachers at all levels must learn to use these enriched varieties of instructional techniques, materials and resources to teach mathematics more effectively.

Recommended Actions

1. The major emphasis on problem solving in the curriculum must be accommodated by a rescheduling of the use of time in the classroom.

2. Teachers should use diverse instructional strategies, materials and resources, i.e. small group work, video tapes, manipulatives.

Recommendation 5

THE SUCCESS OF MATHEMATICS PROGRAMS AND STUDENT LEARNING MUST BE EVALUATED BY A WIDER RANGE OF MEASURES THAN CONVENTIONAL TESTING

Test scores alone should not be considered synonymous with achievement or program quality. A serious danger to the education of our youth is the increasing tendency on the part of the public to assume that the sole objective of schooling is a high test score. This is often assumed without the critical knowledge of what is being tested or whether test items fit desired goals. The evaluation of problem-solving performance demands new approaches to measurement.

Recommended Actions

1. The evaluation of mathematics learning should include the full range of the program's goals, including skills, problem solving and problem-solving processes.

2. Parents should be regularly and adequately informed and involved in the evaluation process.

3. Teachers should become knowledgeable about, and proficient in, the use of a wide variety of evaluative techniques.

4. The evaluation of materials for mathematics teaching should be an essential aspect of program planning.

5. Mathematics teachers must undergo continuing evaluation as a necessary component in improving mathematics programs.

Recommendation 6

MORE MATHEMATICS STUDY MUST BE REQUIRED FOR ALL STUDENTS AND A FLEXIBLE CURRICULUM WITH A GREATER RANGE OF OPTIONS SHOULD BE DESIGNED TO ACCOMMODATE THE DIVERSE NEEDS OF THE STUDENT POPULATION

Technical and vocational training at different levels assumes more and diverse mathematical backgrounds. For those persons whose formal education will end with high school, the needs of the citizen and the consumer for increasing mathematical sophistication dictate a collection of courses based on consumer and career needs, computer literacy, and quantitative literacy.

It is important that recommended programs permit lateral movement and not strictly "track" students, trapping them in a linear pattern that does not permit change to another path. Flexibility is vital, and the key is to keep options open as long as possible.

It is naive to suppose that just providing mathematics courses as electives will serve for equality of opportunity. All reasonable means should be employed to assure that everyone will have the foundations of mathematical learning essential to fulfilling his/her potential as a productive citizen. The currently underrepresented groups should be especially encouraged and helped.

The student most neglected, in terms of realizing full potential, is the gifted student of mathematics. Outstanding mathematical ability is a precious societal resource, sorely needed to maintain leadership in a technological world.

Recommended Actions

1. Schools should increase the amount of time students spend in the study of mathematics.

2. In secondary schools, the curriculum should become more flexible, permitting a greater number of options for a diversified student population.

3. Mathematics teachers and college mathematicians should reevaluate the role of calculus in the differentiated mathematics programs.

Recommendation 7

MATHEMATICS TEACHERS MUST DEMAND OF THEMSELVES AND THEIR COLLEAGUES A HIGH LEVEL OF PROFESSIONALISM

Educators can gain the support of society and the rewards of a truly effective performance by developing, defining, and enforcing professional standards in terms of highly competent professional performance rather than by any other norm. This must be done to provide the nation, its young people, and its future with the mathematics programs worthy of them and of that future.

Within mathematics teaching--

-- there are already many well-prepared and effective teachers who provide outstanding professional leadership;

-- there are also many teachers who are motivated and desire to improve but who lack adequate preparation and must be given the necessary support to become fully qualified and to improve;

-- there are, however, some teachers whose attitudes and functioning are less than a professional level. In the best interests of students and society, the number of such teachers must be reduced immediately.

Even the best prepared, competent, and dedicated teachers must continue their development to keep abreast of changing needs, tools, and conditions. School administrators have the responsibility to make this possible by providing continuing inservice education and by encouraging teachers to take full advantage of opportunities for maintaining their competence that are offered by professional organizations and universities.

Recommended Actions

1. Every mathematics teacher should accept responsibility for maintaining teaching competence.

2. Certification standards for mathematics teaching should be revised and upgraded to incorporate the needs reflected in these recommendations.

Recommendation 8

PUBLIC SUPPORT FOR MATHEMATICS INSTRUCTION MUST BE RAISED TO A LEVEL COMMENSURATE WITH THE IMPORTANCE OF MATHEMATICAL UNDERSTANDING TO INDIVIDUALS AND SOCIETY

The rededication of teachers called for in Recommendation 7 will be meaningless or impossible if society is not committed to supporting the professionalism it rightfully demands. Today, teachers' financial incentives are neither commensurate with the responsibilities they carry nor adequate to attract and retain them in a demanding, crucial, and sometimes burdensome profession. Few school systems have truly adequate

supervisory and material support for the teacher in the maintenance and improvement of the instructional environment. More and more, teachers feel the lack of parental understanding of the complexity of their task and the lack of parental cooperation and support in their efforts to instruct children. Furthermore, governmental support for improving the quality of mathematics teaching has dwindled.

At present, there are too many unnecessary obstacles to the effective functioning of teacher and student in a true teaching/learning interaction. These include more and more time required for unproductive recordkeeping; many unmotivated, undisciplined students; a lack of parental support; ambivalence and vacillation in government regulations; shifting societal priorities; the lack of home and school agreement on out-of-school assignments.

There are also obstacles faced by school administrators and by the policy-making bodies, the school boards, whose ultimate responsibility is the effectiveness of the school district. It is recognized that in many instances confusions of legalism and court decisions impose constraints on the ability of these people to accomplish what they agree should be done. Society today is troubled with many complexities. All institutions are threatened. These obstacles should not be an excuse for inaction; rather, in the light of pressing student needs it is imperative that they be surmounted.

Recommended Actions

1. Society must provide the incentives that will attract and retain competent, fully prepared, qualified mathematics teachers.

2. Parents, teachers, and school administrators must establish new and higher standards of cooperation and teamwork toward the common goal of educating each student to his/her highest potential.

3. Government at all levels should operate to facilitate, not dictate, the attainment of goals agreed on cooperatively by the public's representatives and the professionals.

APPENDIX F

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A paperbound book containing 40 stimulating expository articles from Scientific American magazine on the history, content, and applications of mathematics.

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